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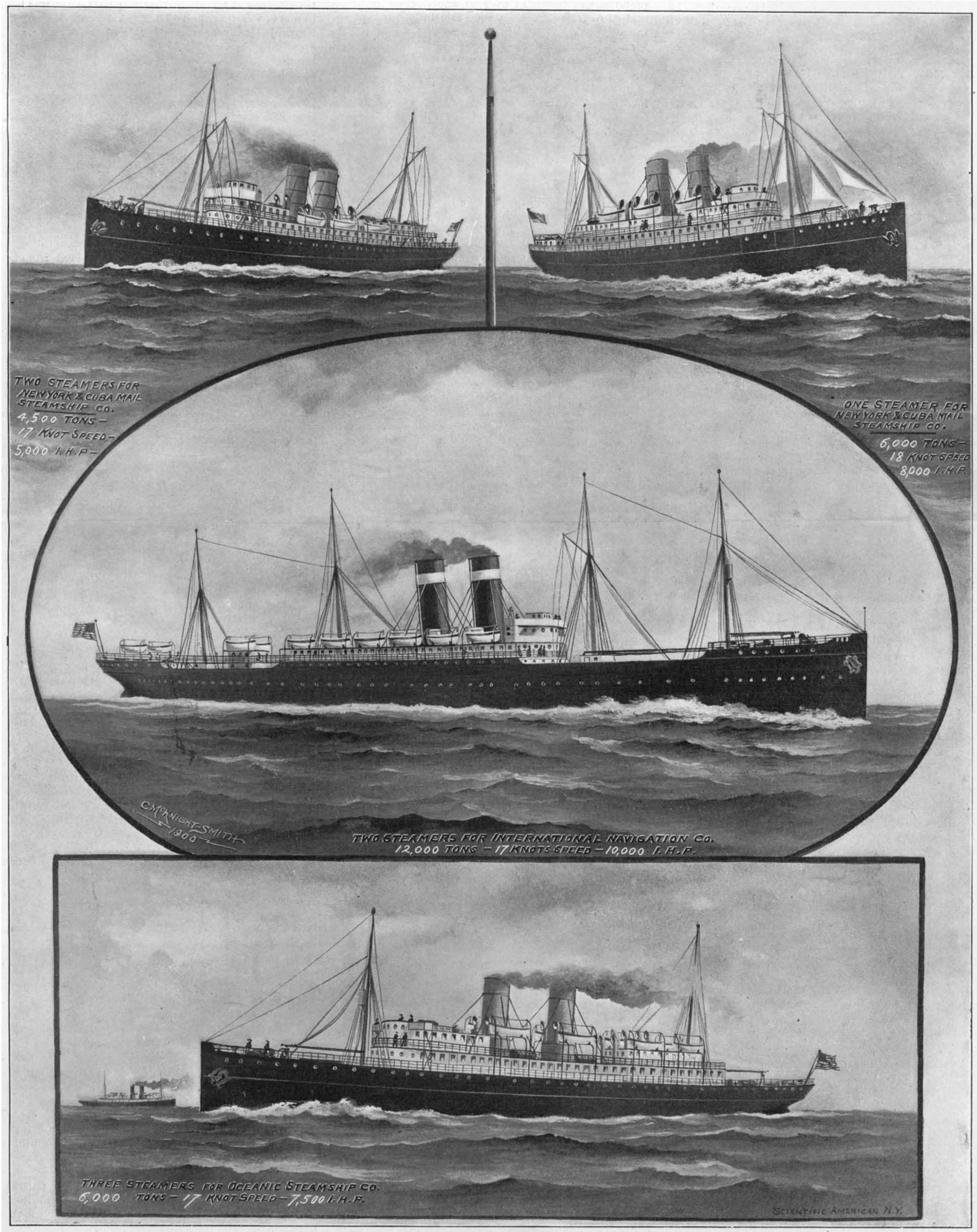
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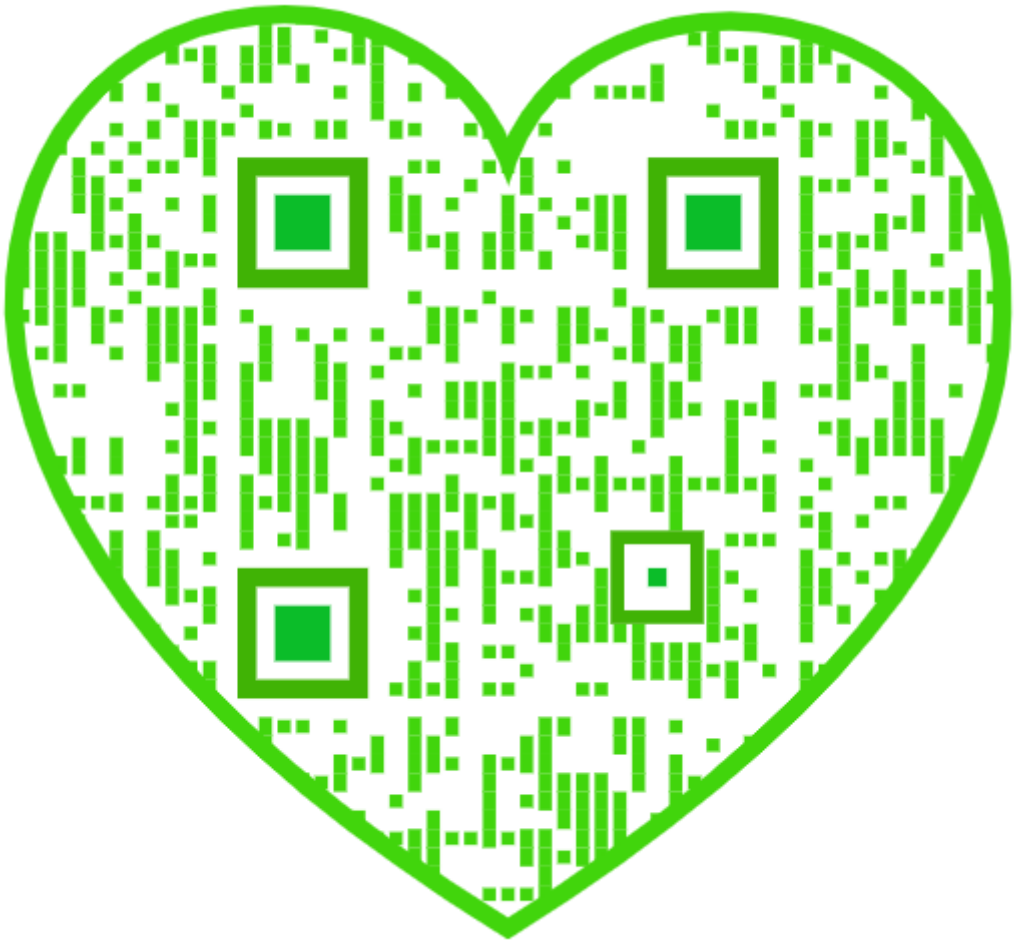
SCIENTIFIC AMERICAN N.Y.

REVIVAL OF THE AMERICAN MERCHANT MARINE—GROUP OF VESSELS NOW UNDER CONSTRUCTION AT THE CRAMP'S SHIPYARD, PHILADELPHIA.—[See p. 278.]



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NEW YORK, SATURDAY, MAY 5, 1900.

REVIVAL OF THE AMERICAN MERCHANT MARINE.

At the present time the majority of the shipping trade of the world is in the hands of Great Britain. Less than half a century ago the leading position was held by this country, which not only possessed the largest tonnage, but was acknowledged to produce the fastest, and in every way the best appointed ships that sailed the high seas. To-day, our deep-sea trading fleet is not only insignificant in comparison with that of the leading maritime nations, but it is ridiculously disproportionate to the resources, the skill and the feverish energy of the nation under whose flag it sails.

The decline of American shipping dates from the Civil War, when the depredations of the Confederate privateers drove into the hands of other nations that portion of our carrying trade which it did not destroy on the high seas. The failure to rehabilitate our merchant marine is not to be attributed to lack of enterprise, but to the diversion of capital into fields where there was a more pressing call and a promise of more speedy results. At the close of the war the energy of the American people was so completely devoted to the internal development of the country by the construction of railways and the building up of industrial establishments, that no attempt was made to save the wreck of our splendid merchant marine, which was left to be completely broken up by the storm of competition which beat upon it with steady persistency.

There was another agency which contributed to our decline, working less swiftly, but, perhaps, with even more potent effect; we refer to the change in the materials of construction and in the motive power of modern vessels as exemplified in the steam-propelled iron ship. Great Britain was quick to adapt herself to the new order of things, and shipyards were reorganized, and multiplied with such rapidity that she at once assumed a position so commanding that it has never yet been disputed. Had the United States deferred her internal development for another decade, and put into the construction of rolling mills and shipyards the wealth and labor which she expended so liberally in covering this country with a network of railways, we think it is not unlikely that we would have held to-day the position now occupied by Great Britain.

At the close of the century we have reached a point in our industrial development where, great as is the extent of the country, large as is its population, production has overtaken and far exceeded the demand. We have built enough, and more than sufficient, railroads; our establishments in many lines of manufactures have a capacity considerably in excess of the demands of the home market; and we are now pushing out into a world-wide competition which, brilliantly begun, is full of even brighter promise for the future. Among the fields of national enterprise that excite our interest, we know of none that should appeal more strongly to our national pride than that of resuscitating our merchant marine and striving to regain, if not the leading position in the shipping trade, one that shall be at least fairly commensurate with our national importance. Among the beneficial results of the late war is the stimulus which it has given to the shipping industry. Our over-sea possessions and our ever expanding foreign trade are creating a demand, the reply to which is seen in the fine fleet of vessels, illustrated in this issue, which are now being constructed on the Delaware and the Clyde. While this activity, however, is gratifying, we must not for a moment imagine that it is on a scale that will do much towards placing us as a maritime people where we properly belong. This can only be accomplished by the adoption of some such sweeping measures as have enabled Germany to advance her shipping interests so rapidly that in the matter of speed, accommodation and size, the ships of its leading companies are probably the best in the world. Germany's success is due, very largely, to the fostering influence of a judicious system of subsidies; and there is a growing conviction that similar means would produce similar results in promoting the shipping interest of the United States.

The scheme which is at present before Congress provides that all American vessels shall receive a bounty of 1½ cents per gross ton for every 100 miles sailed up to 1,500 miles, and an additional 1 cent per gross ton for every 100 nautical miles additional. The building of fast vessels is to be encouraged by granting a subsidy of 1 cent per ton to vessels of from 1,500 to 3,000 tons measurement and 14 to 15 knots speed, and granting $\frac{1}{10}$ of a cent more for attaining a speed of 1 knot greater; while a steamer of 8,000 tons is to receive 2 cents per gross ton if she makes 20 knots an hour, and 2·3 cents per gross ton if she exceeds 21 knots per hour. It is provided that in earning these mileage bounties, a ship must carry at least half her full cargo, while the maximum amount to be paid out for speed premiums to vessels of over 20 knots speed is to be limited to $2,000,000 per year. The bill contemplates the admission to the United States register of vessels built in foreign yards, with the reservation that such vessels shall receive bounty rates only half as great as those paid to American-built vessels. They are also to be subjected to a limitation of ten years as the period for which the subsidies shall continue, whereas in the case of American-built ships, subsidies will be continued for a period of twenty years. Taking it as a whole, we think that if the stimulus of government subsidies is necessary, the provision of the bill as thus briefly epitomized are about the best that can be made.

The day is rapidly approaching when we shall be able to build ships upon the banks of the Delaware and upon the shores of the Chesapeake and San Francisco Bays, as cheaply as they are now built upon the Clyde, the Tyne and the Thames. We can already produce ships' plates and general structural material more cheaply than they can be made in England, indeed, we have already made shipments of the kind to the other side. How far our remarkable advancement in the steel and allied industries is due to government assistance, we do not attempt to say, but the fact is incontrovertible that the industries which have been thus encouraged have had a growth that is absolutely without a parallel. As to the policy of ship bounties, we have yet to find any substantial reason advanced to show why government assistance will not prove as great a stimulus to our shipping interest as it has been to the flourishing industries above mentioned.

THE SINGLE-RAIL SUSPENDED RAILWAY.

The most striking feature of the curious railway which is illustrated elsewhere in this issue, is its novelty, for as far as we know this is the first instance of the construction of a standard elevated railway of the true mono-rail type. The other so-called "mono-rail" systems have required, in addition to the main weight-carrying rail, one or more auxiliary rails for the purpose of steadying the cars and preserving them in the vertical position; while in the Decauville system this duty is performed by laborers or draught animals. Whether this system will prove to be superior to the common type of elevated railway with which we are familiar in this country, has yet to be proved. As far as we can understand the chief advantage claimed is that derailment is practically impossible at high speed. It is said that in the early experiments with the Langen suspended railway, hanging cars of the general type now in use were successfully run around curves of 33 feet radius, at a speed of 15½ miles an hour, with the cars swinging outward on the curves to the extent of 25 degrees from the vertical. This would seem to prove that derailment on the curves of a standard line would be a remote possibility, and, no doubt, the designer has produced a system which will be suitable for lines of excessive curvature over which it is desired to run trains at a high rate of speed. At the same time it is a fact that some of the sharpest curves in the world are to be found on our own elevated railways in New York city, and when we consider the enormous traffic that passes over them, it must be admitted that derailment at these curves is an extremely rare occurrence.

As regards the weight of the cars, it is probable that the suspended type has some advantage over the ordinary car running on two four-wheeled trucks. The concentration of the rolling load upon a single rail should reduce lateral and longitudinal vibration, and tend in every way to smoothness of running. The fear has been expressed that the swaying of the cars would produce uncomfortable symptoms of nausea, intensifying the liability to that "train sickness" to which many passengers are liable when traveling over a crooked road. We think, however, that the fact of the center of gravity of the train being hung so far below the point of support will tend to increase the periods of oscillation so greatly that the lateral sway will be scarcely perceptible, especially if care is taken to eliminate all reverse curves by placing a sufficient length of tangent between them.

In point of appearance and general aesthetic effect it must be admitted that the Langen road, at least as built through the Wupper Valley, is decidedly picturesque, and is less obtrusive, whether in city or country, than the ordinary system of rectangular elevated structures with which we are familiar. Architecturally considered the structure is another tribute to the skill of the German engineers, who have proved in many of their later bridges that most pleasing architectural effects may be obtained without violating the structural or commercial limitations which control, and very properly control, the best modern engineering works.

THE SEVENTH ANNUAL RECEPTION AND EXHIBITION OF THE NEW YORK ACADEMY OF SCIENCES.

BY E. O. HOVEY.

The seventh annual reception of the New York Academy of Sciences, with its accompanying exhibition of specimens, preparations and apparatus to illustrate the progress of science during the past year, was held in one of the new halls of the American Museum of Natural History on April 25 and 26. There were about one hundred and twenty exhibitors and the number of articles exhibited ran up into the thousands, classified under twelve sections or departments.

The section of anthropology, in charge of Prof. Franz Boas, exhibited three cases of objects taken entirely from collections made by the Natural History Museum during the past year, and indicating incidentally, but very graphically, the broad scope of the anthropological investigations now being carried forward by the institution. The material exhibited was brought from Southampton Island in the American Arctic regions, Arizona, California, British Columbia and the banks of the Amoor River in Northeastern Asia. Among the articles exhibited here those which attracted the most attention, perhaps, were a toboggan made by the Eskimo of Southampton Island from the baleen of a whale, and a series of beautifully embroidered garments made from salmon skin by the Golds of the regions along the Amoor River, and collected for the museum by Dr. Laufer of the Jesup North Pacific expedition. The section of astronomy, under the care of Prof. Rees, made its usual fine display of photographs showing the progress made in making negatives and measurements of stars, star-clusters, nebulæ, etc. An interesting photograph was one of a rainbow sent on from Arizona.

The botanical exhibit, in charge of D. T. McDougal, was large and contained much of scientific, or popular interest in more ways than those merely botanical. Prof. Stone showed a set of new apparatus used in measuring the amount of force exerted by a plant in growing and in determining the effect of electricity upon plant growth. A series of remarkable photographs of plants by J. A. Anderson, attracted a measure of the attention it deserved. Some of the subjects were fungi on a tree-stump, cotton bolls, milk weed pods shedding their seed and dandelions gone to seed. The New York Botanical Garden showed, by means of copies of publications, examples of labels, etc., the progress that is being made in that part of Bronx Park, but the most interesting thing in its exhibit from a mechanical point of view, was an exhibition microscope which has been recently devised by Dr. McDougal, and which consists of a simplified microscope inclosed in a small box of plate glass in such a way that visitors cannot throw the instrument out of adjustment, although at the same time the attendant can readily open the case and change the mount on exhibition.

The progress in chemistry the past year seems to have been largely in the line of synthetic work, and a large series of artificial perfumes and artificial indigo, both French and German, gave some hint of the skill being attained in the technical side of the science. On account of the interest excited in smokeless powder, through its extensive use in the South African war, a small exhibit of the explosive was instructive as showing the numerous forms in which it is put up and the widely varying appearance of the finished product. C. E. Pellew had charge of this department.

The electrical exhibit, which was in charge of G. F. Sever, consisted mainly of new and improved Watt volt, and ampere meters exhibited by some of the largest manufacturers of such machinery.

The department of geology and geography, under R. E. Dodge, brought together a considerable exhibit, the geographical features of which consisted of the books and maps issued during the past year by the United States Geological Survey, and the State surveys of New Jersey and Maryland. The geology was represented by some remarkably rich telluride specimens from Cripple Creek, Colorado, quicksilver ores from Southwestern Texas, serpentine verdalite (verde-antique) from Easton, Pa., clays and shales from Michigan and Alabama, complete series of igneous rocks from Magnet Cove, Ark., and the Yellowstone National Park. Mention should not be omitted of a large volcanic bomb, or ejected block, from the island of Vulcano, near Sicily, and of a mass of curiously weathered eolian limestone, from the Bermudas, exhibited by the Geological Department of the Museum.

Alongside this section was that devoted to palæontology, which was in charge of G. van Ingen, and was devoted almost entirely to the collections made by the Department of Vertebrate Palæontology of the American Museum. The explorations of this department in

Wyoming, Texas and elsewhere, have been wonderfully successful, important finds being made each year. This year the exhibition included a series of fine skeletons of Pleistocene horses and the mammoth, the skull and tusks of a Miocene mastodon and skeletons of the saber-toothed tiger and other carnivorous animals from the Tertiary. In this section the geological department of the museum displayed a portion of the recently acquired Jay Terrell collection of Devonian fishes, showing their heavy construction and the formidable teeth with which they are provided. Passing to the section of zoology, in charge of C. L. Bristol, one of the features of special interest seemed to be the series of anatomical preparations from the morphological museum of Princeton University, including the circulatory systems of several animals, and a series of specimens showing the growth of the young opossums while still in the mother's pouch, Prof. B. Dean showed the last feature for the kangaroo of Australia, also. A fascinating exhibit was that of R. L. Ditmars, and consisted of a number of preparations of the heads of snakes, both venomous and harmless. A series of photographs showed the progress of the Zoological Park in Bronx Park and characteristic poses of many of the animals within the inclosure. The Kny-Scheerer Company made a large exhibit of formaldehyde and other preparations in various branches of natural history, and there was a fine series of corals, sponges, and mollusca which had been collected at Nassau by R. P. Whitfield.

The mineralogical section, with L. Mc.I. Luquer in charge, had about two hundred specimens on exhibition, ranging from the large showy pieces of calcite, fluorite, etc., to the crystallographic treasures of tellurium and other minerals shown by Prof. A. H. Chester. One noteworthy specimen exhibited was a diamond crystal, weighing 4⅓ carats, from North Carolina. The mineralogical department of Columbia University displayed some new apparatus and many rare or new mineral forms.

The department of metallurgy, in charge of H. M. Howe, had models of blast and Bessemer furnaces on exhibition, together with many diagrams and specimens showing the ductility of steel, the evolution of gas by metals during solidification and the effect of aluminium in preventing blowholes, the metallography of steel, etc. A series of specimens showed the alloys made by adding various substances to the molten steel, such as tungsten, manganese, molybdenum and chromium. Special stress was laid on the enduring hardness of tungsten steel. The experimental psychologists have not been idle during the year, as was proven by the exhibit under the care of E. L. Thorndike. The apparatus exhibited showed the improvements which have been recently made in the means for detecting and preserving a record of the various mental phenomena under investigation, and also for projecting the actual records onto the screen for class purposes.

The department of physics and photography, this year in charge of William Hallock, can usually be depended upon for something of interest. P. H. Dudley has continued his work with his stremmatograph, showing graphically the high economy of solid railroad beds, heavy rails, and certain types of locomotives and cars. The assistance which photography can give to physics in certain lines was shown by photographs of manometric flames and of sound waves. The kinetoscope, too, has been called in by R. W. Wood, of Wisconsin State University, to unite in a striking manner successive views of wave motion to produce a harmonious and instructive whole. Apparatus illustrating his diffractive color photography process was also exhibited. Some excessively thin films of metals produced by A. C. Longden, of Columbia University, explained how the colors of certain metals appear by transmitted light. Gold is greenish-blue, silver bluish-gray, and copper yellow in these films.

The officers of the Academy of Sciences for the current year are: President, Robert S. Woodward; first vice-president, Franz Boas; second vice-president, Charles A. Doremus.

FLOATING DRY DOCKS FOR NEW YORK CITY.

In connection with the article which appeared in the SCIENTIFIC AMERICAN, April 21, on the large dry dock accommodation which is to be provided in South Brooklyn, it will be of interest to our readers to learn that the Tietjen & Lang Dry Dock Company have under construction a large sectional dry dock built on the same system as the one illustrated in that issue. The credit for the designing of this type of dock is due to Mr. Frederick C. Lang, whose name has for many years been prominently associated with dry dock construction in New York harbor. The new dock, which is being constructed at the Hoboken yard of the company, is of approximately the same size as the new dock at South Brooklyn. It is being built in 80-foot sections, with a clear opening between the wings of 90 feet. Three sections have been completed and are in place at the yard, and two other sections are well under way. The length of the dock will be 468 feet, and it will be equal to the accommodation of a 500-foot vessel. Another dock of four sections is to be built adjoining the five-section dock, and when it is desired to dock vessels of 700 feet or over, the whole nine sections will be coupled up, making a total over all length of about 800 feet.

THE HEAVENS IN MAY.

BY HENRY NORRIS RUSSELL, A.M.

All other astronomical events of May are incomparably surpassed in importance by the total eclipse of the sun on the 28th, which is of additional interest to us because it is visible in the United States. Though such eclipses occur at some part of the earth's surface rather oftener than once in two years, on the average, the path of the moon's shadow is so narrow that it passes much more rarely through any given region. Only three other total eclipses have been visible in the Eastern States during the present century—in 1806, 1834 and 1869.

The path of totality in the present eclipse begins in the Pacific Ocean, crosses Mexico and the extreme southern corner of Texas, passes out into the Gulf, and enters the United States again near New Orleans, whence it passes in an almost straight line to Norfolk, Va., and out to sea, as may be observed in the map published in the SCIENTIFIC AMERICAN of April 21, 1900.

Crossing the Atlantic almost on the track of the Mediterranean steamers, it transverses the Spanish peninsula, crosses to Algiers, and follows the north coast of Africa into the Tibyan desert.

The shadow-path in the United States is about 50 miles wide. Its central line passes about 10 miles north of New Orleans, 25 miles north of Mobile, Ala., 10 miles north of Columbus, Ga., 5 miles south of Greensboro, Ga., Newberry, S. C., and Wadesboro, N. C., and 15 miles south of Raleigh, N.C., and Norfolk, Va.

These details are given in order to enable the approximate construction of the eclipse track on any convenient map. The duration of totality in the United States varies from 1 minute 10 seconds at New Orleans to 1 minute 40 seconds at Norfolk.

Numerous astronomical expeditions will, of course, be sent to observe the eclipse, and the chances of fair weather at different stations have been carefully considered, and the most favorable ones chosen. The principal work will consist of photographs and drawings of the corona and prominences, and observations of the spectra of the corona and the lower layers of the solar atmosphere.

For those to whom the eclipse is a magnificent spectacle, rather than an occasion for scientific work, the most striking phenomena will be the onrush of the moon's shadow with the tremendous velocity of 2,000 miles an hour, the sudden darkness, and the appearance of the corona surrounding the black disc of the moon.

At the time of eclipse Mercury is about 2° west of the sun, and Aldebaran about 6° S.S.E. Both should be visible during totality. Venus will be too near the eastern horizon, as seen from stations in this country, to be conspicuous.

For those outside the track of the shadow, the partial phase of the eclipse will still be well worth looking at. Along the coast near New York about nine-tenths of the sun will be hidden, and the decrease of light will be conspicuous, the sun appearing through smoked glass as a narrow crescent.

However, since even one-tenth of sunlight is some 60,000 times as bright as the strongest moonlight, day will by no means be turned into night for New York, even at the time of greatest eclipse.

THE HEAVENS.

At 10 P. M., in the middle of May, the splendid constellations which make the evening sky of April the most brilliant of the year have all set except Gemini in the west and Auriga in the northwest. Before the brightest star, Capella, of the latter constellation, is lost from the evening skies, it is worth while to note that it has recently been shown by spectroscopic evidence to be double, consisting of two components of almost equal brightness which revolve about one another in an orbit comparable in size with the earth's in a period of about 100 days.

This "spectroscopic binary" is unusually interesting since on account of its relative nearness to the earth there is reason to hope that its components may be separated visually with the aid of the greatest of present-day telescopes, thus giving us an accurate knowledge of its mass and distance.

Leo is high in the west, and the Great Bear between him and the pole. Almost overhead shines Arcturus, and on the east is the semicircle of the Northern Crown, while further south, and near the meridian is Virgo, marked by the white star Spica.

The Milky Way lies low along the eastern horizon, with several fine constellations near its course.

In the northeast is the cross of Cygnus, now prone upon its side, and above is the blue-white Vega. Just rising in the east is Altair and in the southeast Scorpio lifts his claws well above the horizon, and the red Antares blazing in his heart, though his long curving tail is still out of sight.

THE PLANETS.

Mercury is morning star during the earlier part of the month, but too near the sun to be well seen. It passes superior conjunction on the 29th, and changes from morning to evening star. During the eclipse of the 28th it will be conspicuous some 2° west of the sun. Observations of its brightness at this time are planned by some observers, who will take advantage of the eclipse to observe it much nearer the full phase than has ever been done before.

Venus is evening star in Gemini, setting nearly four hours after the sun on the 1st, and about two and a half hours after sunset on the 31st. It is apparently approaching the sun, and is in reality rushing forward to come almost between the earth and sun next July.

Its greatest brightness occurs on the 31st, when it is fully one hundred times as bright as an average first magnitude star. Toward the end of the month its crescent phase will be visible in a good field-glass, especially during twilight, when the glare of the planet is diminished.

Mars is morning star in Pisces and Aries, rising about an hour and a half before sunrise, and very unfavorably placed for observation.

Jupiter is in Ophiuchus, north of Antares, and moves westward about 5° during the month. It comes into opposition on the 27th, rising about 7 P. M., but is in an unfavorable position on account of its great south declination.

The same statement applies with even greater force to Saturn, which is in Sagittarius, some 30° east of Jupiter, and about as far south as it can possibly get. It rises about 11 P. M. at the beginning of the month, and 9 P. M. at the close.

Uranus is in the Scorpio, about 2½° east and 1° south of Jupiter on the 1st. It is in opposition with the sun on the 31st, and may be distinctly seen with the naked eye on a clear moonless night, but is hard to distinguish from faint stars. By making two or three sketches, at intervals of a few days, of the stars visible with an opera-glass southeast of Jupiter, the planet may be identified by its slow westward motion. Its greenish color, visible in a field-glass, aids the search. Neptune is in Taurus, too near the sun to be observed.

THE MOON.

First quarter occurs on the afternoon of the 6th, full moon on that of the 14th, last quarter on the evening of the 21st, and new moon (accompanied by the solar eclipse) on the 28th. The moon is farthest from the earth on the night of the 8th, and nearest on the afternoon of the 24th.

The moon is in conjunction with Venus, though not closely, near noon on the 2d, with both Jupiter and Uranus on the afternoon of the 15th, with Saturn on that of the 17th, Mars on the morning of the 27th, Mercury on that of the 28th, a few hours before the eclipse, and finally with Venus again on the afternoon of the 31st.

Princeton University Observatory, April 21, 1900.

PARIS EXPOSITION NOTES.

The portion of the Paris Exposition at Vincennes is even more backward than the sections in Paris proper. Some of the buildings were only recently begun. The "Pauillac" accident interfered greatly with the American Machinery Hall.

The new hotels which have been built near the Trocadero have metamorphosed the entire quarter of Paris, and have very much improved it. One group of hotels has 1,800 rooms, and at least three times that number of guests can be accommodated.

The gates of the Paris Exposition are now closed at six o'clock in the evening. Then freight cars and wagons loaded with exhibits enter the grounds. Work is not interrupted during the time that visitors are on the grounds. The moving sidewalk is now in good working order and is crowded all day long. It makes a complete tour of the Exposition and will take the place of the Eiffel Tower, and of the Ferris Wheel of our own last Exposition.

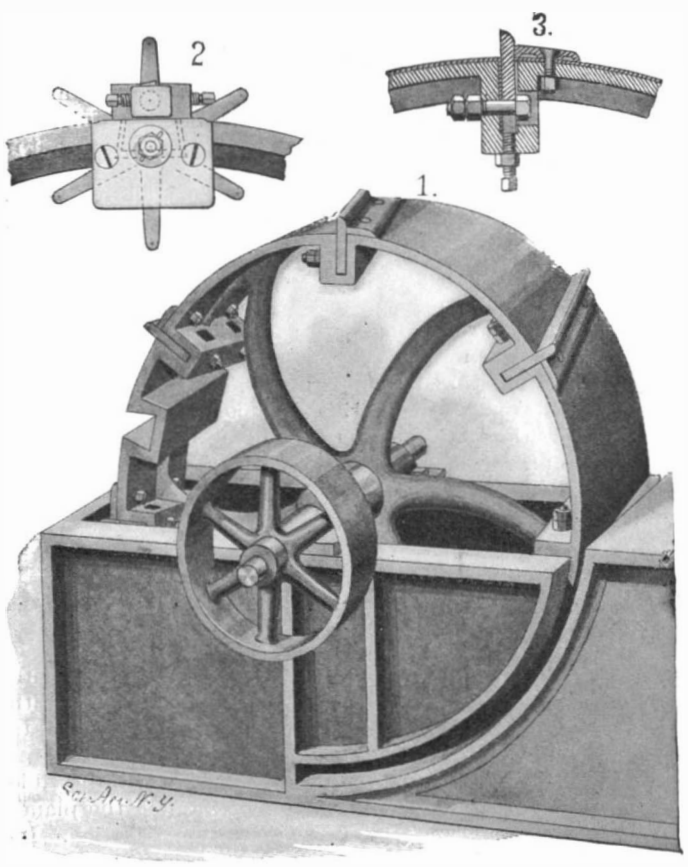
We have already referred to a unique map of France made of precious stones which illustrates the enormous mineral wealth of the Ural district. The 106 chief towns of France are represented by precious stones set in gold. Thus, Paris is indicated by a rubellite of pink color. Other places are represented by such stones as emeralds, sapphires, tourmalines, chrysolite, beryls, aquamarines, amethysts, and chrysoberyls. The names of the towns are in gold and the rivers are made of platinum.

DEATH OF THE DUKE OF ARGYLL.

George Douglas Campbell, Duke of Argyll, died on April 24, after a long and active life as statesman and scientist. He was born in 1823, and succeeded to his father's titles in 1847. He took an active part in politics, and was well known as a theologian and public speaker. His works of a scientific nature dealt to a certain extent with theology. They include: "The Reign of Law," "Primeval Man," "The Unity of Nature," a work on religion and a sequel to "The Reign of Law;" "What is Science?" "Organic Evolution Cross-Examined."

A NEW FORM OF FIBER-CLEANING MACHINE.

An ingenious improvement has been made by Faustino Escalante, of Merida, Yucatan, Mexico, upon fiber-cleaning machines, which have a wheel mounted upon a central shaft and which are provided with peripheral, transversely-projecting bars coacting with a segment-plate to crush and scrape manila fibers, thus



THE ESCALANTE FIBER-CLEANING MACHINE.

very considerably facilitating the separation of the fiber. Hitherto, transverse scraping bars have been attached to the outside of a wheel having a smooth periphery, the bars projecting at such a distance that the leaves are whipped over the edge of the bar, so as to break the fiber. Mr. Escalante has provided bars which project a lesser distance, so as to prevent the whipping of the fiber. He has likewise devised a very simple and effective means of centering the segment plate.

The wheel's periphery is formed with transverse channels, in which adjustable scraping bars are designed to lie with one edge projecting beyond the rim. The bars are bolted in place in the manner shown in Fig. 3. Copper or brass plates, cover the sections of the rim between adjacent scraping bars one end of each plate extending into the channel and being held beneath the scraping bars. Clamping plates, secured to the wheel periphery, hold down the other end of the copper or brass plates. The construction limits the projection of the scraper bars so that there is no possibility of the fibers' being whipped. The manila leaves are introduced between the wheels and the segment plate at that edge of the wheel where the scraper bars are farthest removed from the segment plate, and are gradually worked across the wheel until they have been operated upon by the opposite edge of the scraper bars. The channels in which the bars are held are inclined, so that the manila will be moved transversely to the wheel.

The wheel, as shown in Fig. 1, is also provided with a dove-tailed channel, extending across its rim, which channel is designed to receive the centering device, illustrated in Fig. 2. In this channel a block is mounted to slide provided with a projecting head having a hole extending parallel with the channel, and receiving the stem of a tool. The block and tool are fed across the face of the rim by a threaded bar carrying a star wheel. In order to true the segment plate, the block and tool are put in place, and work is started with the block at one end of the channel. The tool is projected at such a distance as to take a small cut from the inner surface of the segment plate. The wheel is then turned and the block fed by causing the star wheel to strike any fixed object. The block is thus gradually fed along and the tool made to take a series of cuts from the face of the segment plate.

By this means the segment plate can be dressed up after the machine has been set up and can, therefore, be more accurately centered relatively to the wheel. The truing device, it is evident, will be especially serviceable in localities where no machine shop is at hand.

LARGE TRACTION ENGINES FOR SIBERIA.

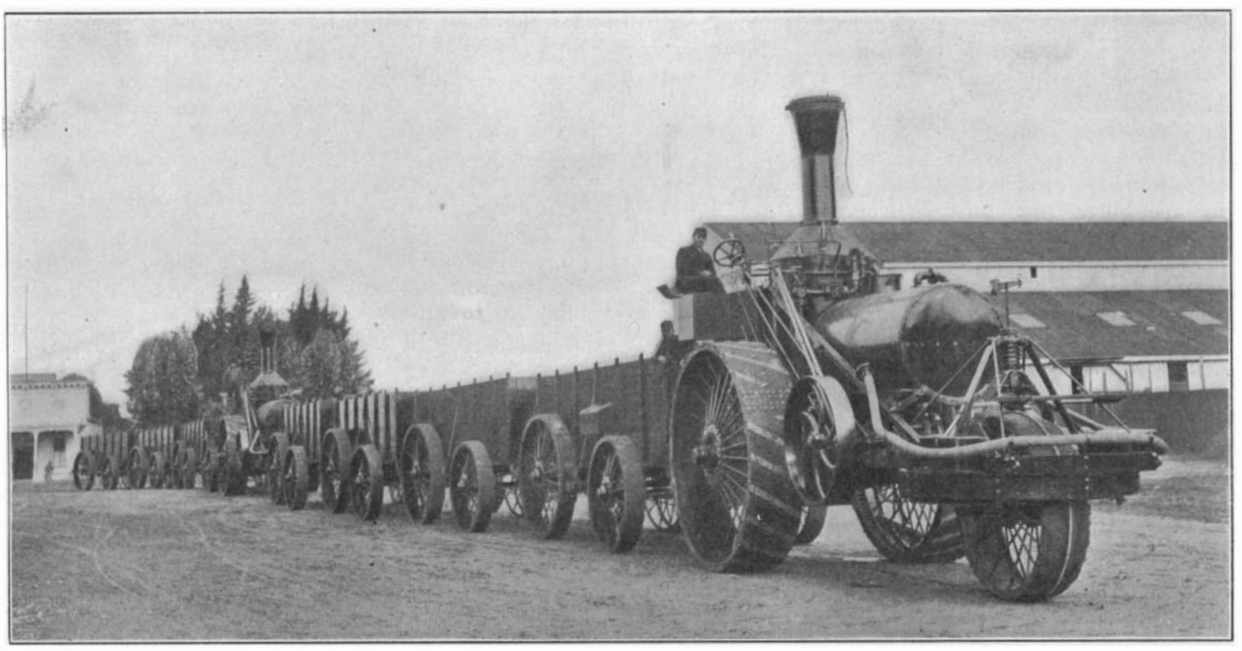
BY ENOS BROWN.

A firm at San Francisco has recently manufactured two of the largest traction engines that have ever been turned out by any California works. These, with six steel freight wagons, were forwarded to Siberia a few days ago for use at the eastern terminus of the Trans-Siberian Railway. Though the distance across the Pacific Ocean to their destination is only about 6,000 miles, the impossibility of transferring from Vladivostock to the point of completion of the railway necessitated fowarding them by way of St. Petersburg, a distance of nearly 14,000 miles. On arrival they will be put to work on the extension of the railway and hauling freight. Should the experiment prove as successful as anticipated orders for a large number in addition will be given. The purpose is to use traction engines as feeders for the main line of railway in place of building branch lines. The shipment is considered significant as indicating the gradual increase of traffic and the hopeful outlook for future business between the Pacific States of America and the newly developed portions of Siberia traversed by the railway.

The new traction engines are not only the largest yet made on the coast, but they combine certain improvements which insure greater economy in the expense of operating, with simplicity of construction. They are of 50 horse power and will haul a load of from 30 to 50 tons, depending upon the quality of the roadway. The boilers are upright with a diameter of 4 feet, and they were tested to 200 pounds. Each has 480 square feet of heating surface.

Attached to the boilers are wrought iron bed plates, 6 × 1 inch, which form the main frames of all the machinery. To these are attached twin engines, 9-inch bore and 9-inch stroke, geared to the main inner cogged periphery of the two large drive wheels. The height of the main drive wheels is 8 feet, with tires 26 inches in width. The steering wheel is 5 feet in diameter and 18 inches wide. The total weight is 13½ tons. An attachment allows the engines to be used stationary if required. The water tank is 40 inches in diameter by 80 inches long, with capacity for 500 gallons. Coal, oil or wood may be used as fuel.

ENGLAND'S recent purchases of horses for use in South Africa has affected the American horse market. Several thousand have been sold in Texas to the British government, at excellent prices. The armies of European countries are constantly increasing in size. With this increase comes the need for more horses. Roughly speaking there are a million horses required for military service upon a war footing in all countries. The Russian army requires 300,000, France and Germany 200,000 and England and the United States 100,000 each.



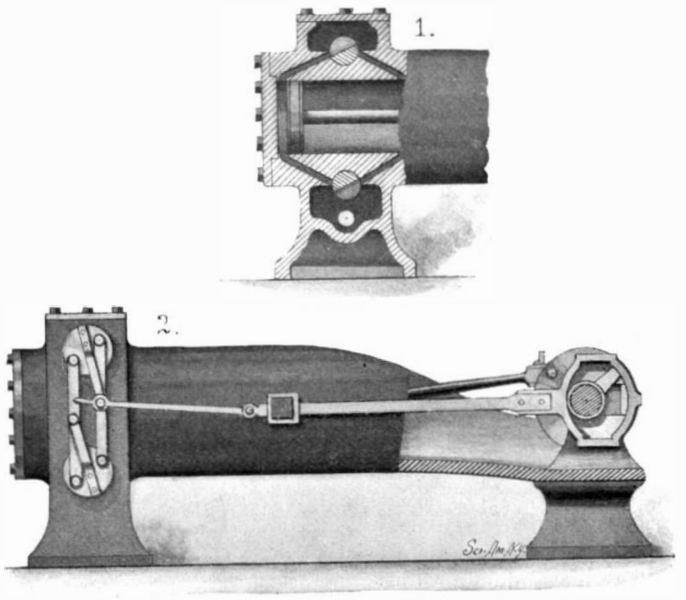
LARGE TRACTION ENGINE FOR SIBERIA.

Weight, 13½ tons. Horse power, 50. Hauling capacity, 50 tons on good roads.

AN IMPROVED ENGINE VALVE-GEAR.

A simple form of valve-gear, designed to actuate multiple rocking valves, and to move these valves in either direction in order to cause the engine to run forward or backward, has been patented by Joseph H. Ansell, Fort Washakie, Wyo. Fig. 1 is a longitudinal section through the cylinder, showing the valves and steam ducts, as well as the piston at the forward end of its stroke. Fig. 2 is a side elevation showing the valve-gear adjusted to open the live-steam valve when the piston is at the forward end of its travel.

Above the longitudinal bore of the cylinder is a live-steam chest, and below the bore an exhaust-steam chest. Cylindrical rocking valves in the steam chests are seated in transverse bores of the cylinder in the thick portions of the wall. The valves have flat sides to reduce their thickness opposite the openings of their



VALVE-GEAR FOR ENGINES.

seats. Two diagonal steam-ducts intersect each valve seat and the longitudinal bore of the cylinder near its ends.

The mechanism for rocking the valves includes two parallel bars pivoted on the outer ends of the valves. A radius-bar is secured at one end on each valve, intermediately of the parallel bars, and each radius-bar is provided with a pin near its free end, and is offset to move over the parallel bars. The end of a jointed valve-rod is hooked to the pin of a radius-bar, and is reciprocated by a cam-block actuated by a cam-arm on the transverse shaft of the engine. As the shaft rotates, its cam-arm reciprocates the cam-block and hence the valve rod, thereby alternately opening and closing diagonally opposite steam inlet and exhaust ports. By disengaging the valve rod from the one radius-bar and hooking it on the pin of the other radius-bar the direction of the shaft's rotation may be changed.

White and Dark Meats in Dietetics.

In a recent series of articles, published in a German medical journal, Drs. Offer and Rosenquist deal with the opinion that has been accepted by many that white meats are more suitable for the sick owing to greater digestibility and the presence of less uric acid and nitrogenous extractives. This belief is shaken by the analysis made by the medical men referred to, which show that while white meats such as poultry and fish do in certain cases, as fish and fresh venison — contain less extractive and nitrogenous derivatives, the average amount does not appreciably differ in dark and white meats such as poultry, veal, beef, pork, mutton, etc., to make either preferable. They point out that the only way of limiting the ingestion of these deleterious extractive and nitrogenous substances is by diminishing the amount of meat taken, rather than by forbidding dark meats. They also asserted that among the extractives present in meat the most important ones are by no means harmful, if taken in small quantities as is ordinarily done. The same holds good as regards the other organic extractives which are nitrogenous.

THE IVES SYSTEM OF COLOR PHOTOGRAPHY.

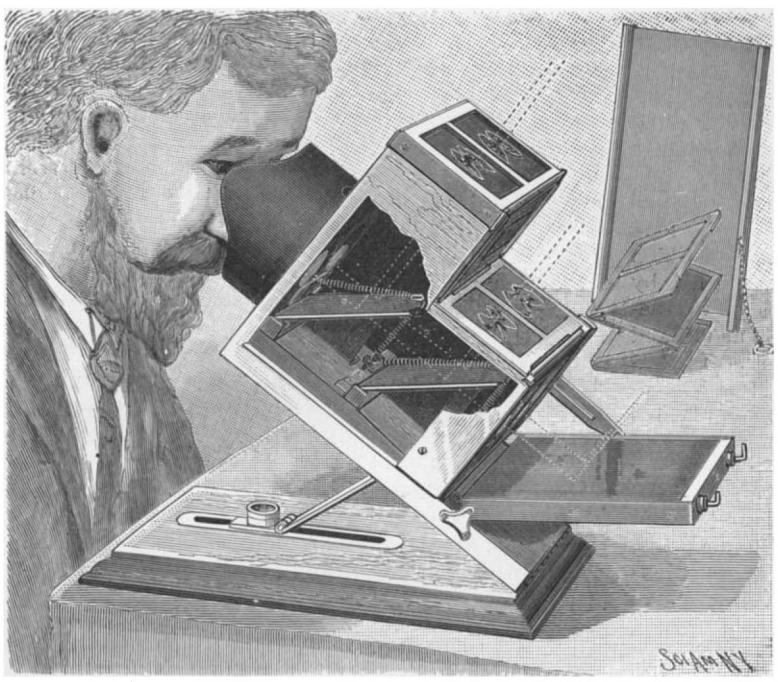
THE KROMSKOP AND THE KROMSKOP CAMERA.

The development of trichromatic color photography appears to have superseded experiment along the older lines, by which it was sought to obtain photographs in natural colors in the camera direct, and this fact is due largely to the work and writings of Mr. Frederic E. Ives, who must also be credited with the attainment of the most perfect results by means of his Kromskop system, in which a "color record" is first made in a special camera, and then viewed in an optical instrument which is used like an ordinary stereoscope.

In view of the fact that the Kromskop system has now been reduced to a remarkably simple and practical basis, and that it yields reproductions which are astonishingly beautiful and realistic, we feel sure that our readers will be interested in a somewhat detailed explanation and description of the method and the special apparatus devised for carrying it out.

As long ago as in 1881, Mr. Ives made trichromatic color prints from half-tone process blocks in the printing press, but it was not until 1888 that he announced the new principle which is the basis of his perfected methods, and by the application of which he then first demonstrated the possibility of accurate color reproduction by an automatic process. This principle, very briefly stated, is that of making the three images of the color record by the action of mixtures of spectrum rays in accordance with Maxwell's color curves, and then optically combining the three images with pure spectrum colors, red, green, and blue, or by superposed prints in the complimentary colors, cyan blue, crimson, and canary yellow. The optical synthesis has always been Mr. Ives' favorite method, and the application of his new principle to this method involved an important difference in the character of the color screens employed in making the photographs and in viewing them, whereas, all other experimenters had employed the same color screens for both purposes—a fatal defect, according to this inventor.

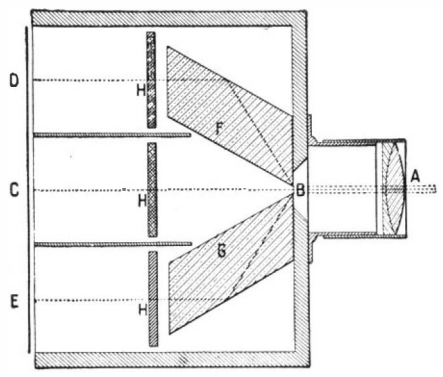
The first demonstration of the method was by means of triple lantern projection; but, with a view to obtain the results by the simplest and most reliable means, and to render them readily available to everybody, he has succeeded in designing an automatic camera that is an exposure camera for making the negatives, and a viewing device to show the perfect reproduction as readily as stereograms are seen in the stereoscope. Many years before, Louis Ducos Du Hauron, in France, had endeavored to do the same thing, but he failed to recognize the distinction which must be made between the taking and viewing color screens, and his viewing device was so crude and imperfect that there is no record of its ever having been exhibited in operation. Undoubtedly the first successful viewing device was Mr. Ives' "Helio-chromoscope," which attracted considerable attention when it was first shown at the Royal Society and at the Royal Institution, in London, in 1892. This device, however, proved too complicated and delicate in its adjustments to meet commercial requirements, and the evolution toward greater simplicity and practicability which has since gone on is a most interesting one. The present viewing device is called the "Kromskop," and the abbreviation of mechanical and optical complications is even more striking than the abbreviation of the name from six to two syllables.



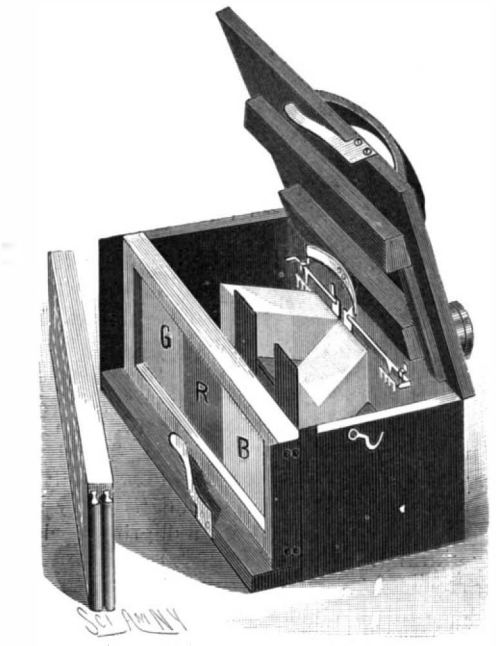
THE KROMSKOP, AN INSTRUMENT FOR VIEWING PHOTOGRAPHS IN THE COLORS OF NATURE.

The Kromskop, although sufficiently elaborate mechanically to make it an instrument of precision, consists essentially of nothing more than a case and four pieces of colored glass. Nevertheless, it seems impossible that any reasonably simple construction could permit of showing an image which should appear larger, or in any way more perfect. Another simpler form of instrument has been recently devised, but only by further optical complication, and by curtailing the apparent area of the image, both of which seem to be inseparable from any departure from the "step-Kromskop" design.

Mr. Ives has also devised the only cameras for making three images of the color record, identical in size and perspective on one plate, at one exposure, from one point of view.* His earlier cameras for this purpose, although efficient, were too delicate in adjustment for regular use. The perfected system is a "one-plate one-exposure" process, as simple in actual operation as the ordinary black and white photography, and is carried out entirely with apparatus which appears to have realized the utmost possible degree of optical simplicity.



SECTIONAL PLAN OF TRI-COLOR CAMERA.



THE KROMSKOP TRI-COLOR VIEW CAMERA.

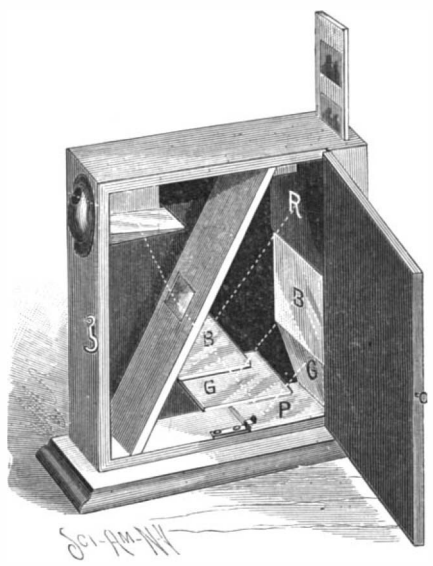
The Kromskop view camera, as shown in our engraving, contains, in addition to the essential parts of an ordinary camera, nothing more than two prisms and three color screens in one frame, blue, red, and green, designated G, R, and B. In making this construction Mr. Ives has very ingeniously taken advantage of the property of a body of glass to extend the focal point of the rays, which form the images on those parts of the plate furthest removed from the view point. The camera is provided with a hinged cover having a handle on the upper side and a flat spring underneath for clamping the prisms. Referring to the diagram, *A* is a simple achromatic lens, focused by means of a slip tube or rack and pinion, with a diaphragm at *B*; the lens normally focuses an image at *C*, which is perfectly defined to the edges of the small image required, but in order to divide the light and form other images at *D* and *E*, the prisms, *F* and *G*, are so placed that their inner front edges partly cover the diaphragm aperture, which then appears like three juxtaposed slits, giving three practically, though not absolutely, identical points of view. The light passing into the prisms is twice reflected, producing unreversed images at *D* and *E*, which, owing to the greater distance from *B* to *D* and *E* than from *B* to *C*, would be of larger size than the middle image and much out of focus, but for the fact that the greater refractive index of the glass as compared with air, extends the focal point, so that the images are equal, except for differences of light and shade introduced by the selective color screens, *H*, *H*, *H*. It seems perfectly safe to say that no simpler optical device could possibly secure three images identical in size and perspective on one plate, from one point of view, at one exposure.

The time of exposure is dependent upon the time required to impress the red and green images on the sensitive plate; for this reason the largest section or central portion of the lens transmits the image direct through the red screen, while the blue violet and green pass through the side prisms. Referring to the view camera engraving there is located between the inner end of the prisms and the back of the lens pivoted diaphragm shutters which, when moved, one way or the other, by the extended levers over a gage observed on each side of the prisms, regulate the amount of light that is to pass through the prism. In this way the actinic value of the light on the plate is adjusted and proportioned so that the blue and the green rays will impress the plate in a given time equally with the red rays, the latter requiring the longest time. The plate holder, made of special length to fit the camera, will be seen on the left of the picture. Special chromatic plates are used.

With this camera, the exposures on a landscape may be reduced to five or ten seconds, under the most favorable conditions. Advantage is taken of the same property of a body of glass to extend the focal point, in a somewhat more complicated camera, which, with a single point of view transmits enough light for portraiture in the studio.

From each triple negative made in these cameras, any number of positive color records, "Kromograms" can be produced by contact printing, as in making lantern slides, and when mounted on an ingenious folding cardboard frame, they are ready for viewing in the Kromskop, as easily as a stereogram is seen in the stereoscope; and the principal Kromskop, which is also a stereoscope, shows not only the colors but the effect of solidity as well, so that the very object itself appears to stand before the eyes.

Referring to the larger illustration, the general appearance and construction of the Kromskop, or viewing step instrument, will be noted. It is tilted at a suitable angle to allow the light to fall equally on all the duplicate images. When viewed without any color record transparencies in place, the screen of the combined colors has a bluish-white appearance. If one of the screens is shaded red, blue or green will appear. The red screen is located just above the viewing lens, on the next step to the right is the blue-violet screen and vertically below that is the green glass screen. Just in front of this is a green colored reflector which illuminates the green screen. In the interior, held in place by spiral springs, are two green glass reflectors located under the blue and red screens, which possess the quality of reflecting the colored images above, without the secondary reflection which occurs when a clear glass reflector is employed, and at the same time transmit the green lower image through them to the viewing lens. The green image in its passage upward through the green reflectors blends, first with blue reflected image, and lastly with the red reflected image as the white dotted lines in the picture show. The three stereoscopic transparencies secured together by flexible cloth joints (partly opened in the engraving) are very readily placed on top of several steps and quickly adjusted to the proper position. At the extreme right corner of the picture is a ground glass screen for equalizing the light falling on the reflector when a clear sky cannot be had. The eye lenses not only magnify but cause the eyes to blend the two sets of images which constitute the complete stereoscopic pair, as in the ordinary stereoscope. The result is a single image in solid relief, and in the natural colors. The color record transparencies simply shade



THE MINIATURE KROMSKOP.

*The Du Hauron camera, recently described in our columns has (optically) three points of view, one behind another, thereby introducing differences of perspective, size, and focus of the three images if the objects are within a few feet of the camera.

or cut out certain portions of color, causing red or blue to predominate as the case may be, and thereby in their various gradations cause a harmonious and pleasing intermingling of colors, photographically recorded, which reproduces an image in the natural colors of nature.

One of our engravings shows another modified form more simple, non-stereoscopic, which gives a smaller though equally as perfect a color reproduction of the step-Kromskop, and is called the miniature Kromskop.

In this case the kromogram is made up of the three color record pictures on one plate, as will be seen at the right end of the picture, where one end of the transparency projects upward.

To avoid distortion in viewing these images at an angle of 45°, Mr. Ives devised a special correcting combination, consisting of a prismatic lens and a prism, observed in the center of the diagonally placed board, and just below the view aperture. One side of the instrument forms a hinged door, so that access can be had to the interior.

R, *B*, *G*, are the three color screens respectively red, blue and green, in front of which the kromogram is placed. The light passes through the kromogram images and the color screens in the direction of the dotted lines, *R*, *B*, *G*, the green being reflected by the silvered mirror, marked *P*, and the other colors by the transparent colored glass mirrors, *G* and *B*, along one line, through the prismatic lens on diagonal board, and the prism fixed just below the eye aperture.

From a personal examination of these color record transparencies in the two viewing instruments just described, we have been more than satisfied with the remarkable natural blending of colors that were produced and were particularly interested in the quick, simple, yet scientific way in which all the adjustments and results are obtained.

Mr. Ives has constructed a color-projecting attachment for lanterns which is very effective and accurate in its adjustments. This we shall hope to describe at another time.

In the correct optical rendering of photographic pictures in the colors of nature, the Kromskop certainly can be compared in its effectiveness and importance to the phonograph as a reproducer of sound, or to the kinetoscope in the reproduction of motion.

A commercial use suggested for this instrument is that colored articles such as rugs, carpeting, and china, and other kinds of merchandise, can be presented in their original coloring to the prospective purchaser, and thus save the expense of transportation and display of actual samples by the manufacturer.

We are informed that Mr. Ives is regarded as being the first to invent and protect by patents the only practical photo-chromoscopic apparatus that has been placed on public sale, and that several medals have been awarded to him by important scientific societies at home and abroad.

THE UPBUILDING OF THE AMERICAN MERCHANT MARINE.

The public has heard a great deal recently about the revival of American shipbuilding, particularly as regards that branch of it which is devoted to deep-sea navigation, and we now take pleasure in presenting illustrations of a fleet of a dozen American freight and passenger steamers which are being constructed on the Delaware and the Clyde. Eight of these vessels are upon the stocks at the yard of the William Cramp & Sons Ship and Engine Building Co., Philadelphia, while the other four are building at the shipyard of the Clydebank Engineering and Shipbuilding Co., Glasgow. By far the most important of these boats are four large steamers of 12,000 tons measurement and 17 knots speed which are being constructed for the Red Star Line service between New York and Antwerp; two of which, the "Vaterland" and "Zeeland," are being built by the Cramps, and the other pair by the Glasgow firm above mentioned. The boats will take rank among the largest afloat. They are 560 feet long, 60 feet wide, and 42 feet deep. They are, of course, fitted with twin screws, and the twin engines in the case of the "Vaterland" and "Zeeland" will be of the quadruple expansion type, and in the case of the other two boats, of the triple expansion type. The maximum indicated horse power will be 10,000. There will be accommodations for 300 first cabin, 250 second cabin and 750 steerage passengers. The cabin passengers, both of the first class and second class, will be carried in the bridge deck house amidships, and the majority of the rooms will be deck cabins. There will be a certain number of first cabin suites, each of which will include a sitting-room, a bedroom, and a bathroom. On the promenade deck, which will be of the generous proportions which are found on recent ships of this type, will be a large library and a smoking-room, while the first-class dining salon, which is situated amidships on the upper deck, will be large enough to accommodate all the passengers at one sitting.

The second cabin accommodations will be amidships, chiefly in the deck house, so that most of these rooms, also, will be deck cabins. The dining salon will have the added attraction that comes from being placed near the center instead of, as is usually the case, at the stern of the vessel. A feature of these ships which is worthy of particular note is the successful attempt which has been made to render life in the steerage more comfortable. The accommodations consist largely of two, four and six-berth rooms, all of which are well lighted and ventilated, while ample lavatory accommodations have been provided. A distinctly modern innovation is the provision of a large social hall.

From the above description it will be seen that these fine ships hold a position midway between the modern ocean greyhound and the modern cargo and passenger ship of 14 and 15 knots speed. They will make the trip from New York to Antwerp in eight days, steaming about 17 knots an hour. The International Navigation Company, or the American Line, as it is more popularly known, for whom these ships have been built, is also having two steamers of similar design and speed, but of 10,000-ton measurement, constructed at Glasgow for the Philadelphia-Liverpool service.

The New York and Cuba Mail Steamship Company has under construction at the Cramp's yard three freight and passenger steamships which are to carry cattle, fruit and merchandise between New York and Cuba. They will be ranked as second-class vessels under the Subsidy Act of March, 1891. The vessels, whose general appearance is shown in the drawing on the front page of this issue, will contain three decks, in addition to hurricane and shelter decks. They will be built of steel with the usual cellular bottom and watertight compartments, and will be provided with bilge keels to give steadiness in a sea-way. It will be noticed from the illustration, they will have a high freeboard, a feature which will conduce greatly to good sea-going qualities and general comfort. One of these vessels, the "Morro Castle," will be of 6,000 tons measurements, 400 feet in length, 50 feet in width and 36½ feet in depth. On a draught of 20 feet she will have a deadweight capacity of 3,400 tons of freight and 800 tons of bunker coal. She will be driven by two four-cylinder triple-expansion surface-condensing engines with a combined horse power of 8,000. With this maximum indication the engines will run at 100 revolutions per minute, when the boiler pressure is 170 pounds to the square inch. The sea speed will be about 18 knots per hour. Two others are being built which will be of 4,500 tons gross measurement. They will be 341 feet long, 47½ feet wide, with a depth of hold of 36 feet. The draught will be 30 feet on a deadweight carrying capacity of 3,000 tons of freight, and 360 tons of bunker cool. The twin three-cylinder triple-expansion engines will indicate 5,000 horse power at 97 revolutions per minute, when the boiler pressure is 160 pounds to the square inch. The largest of these three ships will accommodate 150 first, 85 second and 100 steerage passengers, while the two sister ships of 4,000 tons measurement will accommodate 125 first, 85 second and 100 steerage passengers. The speed of these three vessels will be about 17 knots per hour, as against a speed of 18 knots per hour for the "Morro Castle."

The Oceanic Steamship Company, which, for many years has maintained a service between San Francisco and Sydney, N.S.W., calling at Honolulu, at our newly acquired island of Tutuela and at Auckland, New Zealand, is having three handsome vessels constructed at the Cramp's yard, and these, like those above mentioned, are steel veseels, of first-class construction with double bottom, bilge keels and extensive subdivision by watertight bulkheads. The new boats are 400 feet in length, 50 feet in width and on a draught of 23 feet have a gross measurement of 6,000 tons. The twin-screw, triple-expansion engine will indicate 7,500 horse power and drive the vessels at an average sea speed of 17 knots an hour. The ships are specially designed for the requirements of the long trip across the Pacific Ocean, the larger part of which lies within the tropics. They are distinguished by the large port-holes and abundant means of ventilation which have earned for the old "Alameda" and "Mariposa," of this company, a well-deserved reputation. Because of the great distance between coaling stations on this run, the ships are to be provided with the liberal bunker capacity of 2,000 tons.

Although the American merchant marine has a long road to travel before it reaches the proud position which it once held, the fine fleet of vessels depicted in our front-page engraving is cause for justifiable pride, and without indulging in over-sanguine expectations we may look upon it as an earnest of a great revival of deep-sea shipbuilding in this country.

The Latest Work of the Palestine Exploration Fund.

The Turkish government has granted the Palestine Exploration Fund a firman to excavate over an area of ten square kilometers, and the region marked out for the operations is on the borders of Shephelah, or old country. It was found that three promising sites for excavation, viz.: Tell Judeideh, Tell Zakariya, and Tell-es-Safi, could be brought within the limits of the permit. On October 26, 1898, work was begun at Tell Zakariya by Dr. Bliss and Mr. Macalister. It is a hill rising abruptly 350 feet above the Vale of Elah, and is 1,050 feet long and 450 feet broad. Dr. Bliss found on the top of the hill the walls of a fortress, to which six towers had been added at a later date. A large part of the area enclosed by the walls has been excavated down to the rock. It has been proved that the fortress has been built after a considerable amount of débris had accumulated on the mound, possibly in the Jewish period. The fortress was simply an enclosure for protecting houses within, and the datable objects range from pre-Israelite to late Jewish times, with a small proportion of later objects. It appears to be probable that the place was inhabited when Joshua conquered the land; that it was fortified in Jewish times; that it was occupied until a later Jewish period, and that during the Roman period there was a brief occupation, after which it appears to have been deserted. Interesting potsherds have been discovered. Tell-es-Safi gives great promise and it is likely that it represents the Biblical Gath.

Automobile News.

It has been suggested that automobiles be named in the same way as a yacht.

An exhibition of motor carriages under the auspices of the Austrian Automobile Club will open at Vienna on May 31 and will continue until June 10.

There seems to be an excellent opening for the sale of motor cars in Spain. In many of the provinces there is not a very extensive railroad communication and there seems to be an excellent prospect for the introduction of motor car, passenger and goods services between many places in the provinces of Spain.

In a new automobile which has been designed for doctors' use, the doctor is his own driver. He sits inside and obtains an uninterrupted view through large glass windows on all sides, the steering and manipulating devices being readily accessible from his seat. Inside the body is also a space for instrument cases and other necessary articles carried by a doctor. There is a headlight, reading light and side lights. The vehicle is an electric one.

Gottlieb Daimler, the inventor of the Daimler motor, died in Germany a short time ago. He became associated with Dr. Otto some thirty years ago, and in their little workshop at Deutz, the Otto gas engine was constructed. Herr Daimler finally started in business for himself and undertook the production of an engine using gas made from petroleum. According to The Automobile the first attempt to construct an automobile at the Daimler works was about fourteen years ago.

A series of eighteen questions has been prepared for the examination of Chicago automobile operatives. Regular examinations are required and the police are instructed to see that the ordinance is inforced. Good eyesight, sound hearing and a stable nervous system are required. The questions relate largely to the special type of vehicle which is to be used, also questions relating to the responsibility of operating a vehicle on the public streets, whether the operator has ever had any accidents or not, etc. The rules and regulations seem to be thoroughly common-sense and ought not to be objected to by anyone. Nothing will hurt the automobile industry more than a series of accidents.

At the recent German military maneuvers, four-wheeled automobiles containing an officer and driver were used, for the most part, for the speedy conveyance of the elderly staff officers, and some of them ran at a speed as great as 30 or 40 miles an hour. In the Franco-Prussian war a hard day's march of twenty-four hours for transport wagons was 50 miles. At the end of each march, the horses were useless. In the recent maneuvers motor wagons traveled at the rate of 7 miles an hour, and a day's work of ten hours was 70 miles. War authorities consider that the day is not far distant when train horses will be replaced to a considerable extent by petroleum motors. The Kaiser takes the greatest interest in this new development, and a number of officers have been set apart to study motors and impart instructions to their subordinates.

A bill was passed by the Wisconsin State Legislature on March 5, 1875, which virtually offers a prize of $10,000 for an invention. The Motor Vehicle Review recently investigated the law, which was found on the statute books. The first section of the law enacts that the sum of $10,000 shall be paid to any citizen of Wisconsin who shall invent and, after five years continuous trial and use, shall produce a machine propelled by steam or other motive agent which shall be a cheap and practical substitute for use in place of horses and other animals on the highway and farm. Any machine entering for the prize must perform a journey of at least 200 miles on the common roads of the State, on the continuous line north and south, propelled by its own power at an average rate of at least 5 miles per hour working time. The other sections provide that the vehicle must be of such construction and width as to conform with or run in the ordinary track of the common wagon or buggy and be able to run backward or turn out to accommodate other vehicles. It must also be able to ascend and descend a grade of 200 feet for a mile.

Science Notes.

The scientific results of the Norwegian Polar expedition will soon be published. It will edited by Dr. Nansen.

Miss Catherine Wolfe Bruce who gave most generously for the advancement of astronomical science, died a short time ago.

The Glasgow International Exhibition opens May, 1901, and application for space must be made not later than June 1, of the present year.

Prof. Alphonse Milne-Edwards, the distinguished French naturalist and Director of the Museum of Natural History of Paris, died suddenly April 21, in his sixty-fifth year.

Color photography will, doubtless, in time be of great use for reproducing the medical and surgical aspects of disease. Mr. Ives has experimented upon this subject with his "Kromskop." It is easy to see its usefulness for lecturing and teaching purposes.

The American Geographical Society will no longer hold its public meetings in Chickering Hall, New York, as the building is soon to be removed to give room for another structure. For nearly a quarter of a century the society has had the most celebrated explorers and traveler in the world to address them. The society will soon begin the erection of a fine building on Eighty-first Street, near the Museum of Natural History.

A volcanic eruption has occurred at the southeastern extremity of the island of Luzon. There are several extinct volcanoes in this province, but Mayon has always been more or less active. The eruption took place on March 1 about 2:30 in the afternoon. Large stones were hurled up, and finally streams of red hot lava could be seen coursing down the mountain side, and one of them apparently reached the sea some 6 miles away. On March 4 the eruption seemed to be practically over, but steam was still rising from the hot lava and the mountain was obscured with smoke.

San Francisco has had quite an epidemic of fish poisoning. Oysters have been a frequent cause of ptomaine poisoning. Most of the oysters consumed are obtained from beds situated in or about San Francisco Bay, the waters of which, says The Pacific Medical Journal, are never thoroughly changed. There is considerable tide, but the stagnant water from the sewage of surrounding towns flows into bay. The oyster, as well as the lobster, crab and shrimp, are natural scavengers, and they should be raised or gathered only in waters having no sewage pollution, and waters having free access to the ocean.

The engineers and workmen on the Jungfrau Railway, who are obliged to remain a considerable time at an altitude of about 10,000 feet above the sea level, are apt to develop a disagreeable complaint. After eight or ten days they are seized with violent pains in several teeth on one side of the jaw, the gums and cheek on the same side becoming swollen. The teeth are very sensitive to pressure, so that it is painful to eat. These symptoms increase in severity for three days and then gradually disappear. All newcomers appear to suffer from the same complaint and they do not have any recurrence of the trouble.

The London County Council has passed some by-laws which are interesting. 'One of them forbids the use of flash or searchlights for advertising purposes. By flashlight is meant a light used for the purpose of illuminating or exhibiting words, signs, etc., which alters suddenly in intensity, color or direction, and by searchlight is meant every light exceeding 500 candle power, whether in one lamp or lantern, or a series of lamps or lanterns used together and projected as one concentrated light, altering either in intensity, color or direction. The fine for every such offense is not to exceed five pounds sterling. Recommendations have also been passed requiring a sufficient support for every person standing on window-sills for the purpose of cleaning windows at all heights above 6 feet from the ground. Another by-law stops street shouting, and in a short time London will probably be the best regulated city in the world as regards street nuisances.

At the meeting of the Department of Superintendents of the National Educational Association, at Chattanooga, Tennessee, in 1898, a committee was appointed to propose a plan for prosecuting a scientific inquiry for the determination of the factors involved in the proper seating, lighting and ventilating of school buildings. This committee made a report and the council appointed a committee and $2,100 was appropriated for prizes. For the best essays submitted on each of the following topics a prize of $200 will be given: The seating, lighting, heating and ventilating of school buildings, and for the second best essay submitted on each topic, $100 will be offered. Each essay will be limited to 10,000 words, and must be printed or typewritten, must not be signed, but the name of the author must be enclosed with it in a sealed envelope, and not mailed later than February 1, 1901, to A. R. Taylor, Chairman of the Committee, **Emporia, Kansas.**

Engineering Notes.

The Pennsylvania Railroad Company is experimenting with nickel steel rails.

On a branch of the Northern Pacific Railway submerged water tanks are used, means being provided for forcing the water out of the well with the aid of steam from the boiler.

There are thirty-three jute mills in India, employing 94,540 persons. The mills contain 13,371 looms and over 278,000 spindles. Nearly all of the mills are in the neighborhood of Calcutta.

A British steamer is now being loaded at Sparrow's Point to sail for Vladivostock and will carry the largest cargo of steel rails ever taken from an American port by one vessel. The shipment will amount to 8,700 tons.

The importation of calcium carbide into Servia has been forbidden on the ground that acetylene would diminish the value of the government petroleum monopoly. It seems as though the same result could have been obtained by levying a heavy import duty.

The largest smokestacks which have ever been manufactured in the United States are now being built by the St. Louis Transport Company. They will be 70 feet in circumference at the base and gradually taper to 40 feet in circumference at the top. They will be 200 feet high and will cost about $20,000 apiece.

The French authorities have recently built a new armored train. The locomotive is encased by a conical hood which developes into the cylindrical envelope with which the cars are covered. At the ends of the cars the armor overlaps so as to give a rather serpentine appearance to the train as it winds around a curve.

There is to be a cordite factory built in India. Electricity will be used for motive and lighting purposes. The bulk of the cordite used in India has been heretofore imported, and the government factory at Waltham Abbey in England cannot supply it in sufficient quantities, so that orders have to be placed with private firms.

The question of the right to use a bicycle on railway tracks has just come up for decision. A Minnesota man devised an adaptation of a bicycle enabling its use after the manner of the regular railroad tricycle. The question of the right of the railway company to prohibit the use of such machines is involved. In making answer to the inquiry the Commission took the ground that the use of such a machine was in the nature of placing an obstruction upon the tracks of the railroad company and, therefore, says The Railway Review, is expressly prohibited by law.

The Fountaine Marchand in Paris is to be demolished in a short time. There are now no fewer than eleven fountains in Paris at which water is sold by the bucketful, the price being one centime, In 1860 the amount received from this source was 700,000 francs, says The British Architect, but in 1882 it shrunk to 40,000 francs. Now, however, the guardians of the fountains probably sell a bucketful of water a month each. Their office, however, is maintained as a comfortable sinecure for superannuated servants of the water company who receive $100 a year and gratuitous lodgings.

The problem of transportation across crowded waterways is modified by local conditions, among which one of the most important is the amount of rise and fall of the tide. Methods that are practicable for a small range of tide, are impracticable when the variation is extreme. Thus, the ferry floating pontoon landing system universally in use at New York is impracticable in such a place as St. Malo, France, where the daily variation of 40 feet is overcome by an elevated platform traveling on rails laid at the bottom of the harbor. Again, the medium rise and fall of 14 feet at Glasgow was overcome by Wm. Simons & Company, of Renfrew, by the construction of the curious elevating platform ferry, illustrations of which were given in the SCIENTIFIC AMERICAN of April 7, 1900.

It is ordinarily rather difficult to sample pig iron, but a simple and effective device for doing this work has been presented at a meeting of the American Institute of Mining Engineers. It consists of an ordinary plumber's gas T, over the leg of which is snugly fitted a small tin cup to catch the drillings which are made by a breast drill with a ¼-inch twist-bit working in the arm of the T. The forward arm of the T is filed down to a blunt edge, over which is stretched a short piece of rubber tubing projecting a little beyond the end. The bottom of the inside of the front arm of the T is filed down at an angle to facilitate the passage of drillings into the cup. The rear arm of the T is fitted with a tin ring, which holds in place a stiff spiral spring which presses the tool firmly against the metal being drilled. The other end of the spring is supported against a shoulder of the breast drill. The projecting rubber prevents the loss of any drillings and prevents the filling in of sand. A number of pigs can be sampled by making small holes; thus the average can be obtained.

Electrical Notes.

The Chicago Electric Traction Company will possibly abandon the storage battery system for the overhead trolley. The former system has proved successful on single lines.

A similar system could undoubtedly be used to great advantage in libraries and in many places where light weights have to be transported a long distance at a high rate of speed.

The Manhattan Elevated Railway Company, of New York, is considering a plan for providing its stations with inclined stairways. Such elevating means would have a capacity of 3,000 persons per hour. The stairways will be run on the endless chain principle, and will be actuated by electricity.

The Street Railway Company, in Norfolk, has complied with an act recently passed by the Legislature to provide separate cars for colored people. The company which has done this is the first street railway company to observe the law. By this arrangement the colored people are carried in trolley cars.

An electrically-driven saw has been found to be of great use in surgery. The shaft upon which it runs is connected with a motor by a flexible spiral coil enclosed in a braided sheath. The machine has been extensively used in the larger hospitals, and operations that have been usually fatal with the old hand-saw, have been very successful with the new ones.

Nearly all of the jute mills in India are now lighted with electric lights. It was found that the working people could work overtime under much better conditions with increased pay in the electric-lighted mill; the consequence was that the workmen flocked to the well-lighted mills so that those mills, which opposed the introduction of electric light were forced to provide it.

An electrical telpherage system has been used with satisfaction in the offices of a German insurance company. A box for the purpose of carrying papers is suspended from the car and the whole affair is driven by a one-tenth horse power motor. The current is taken off from a bare copper wire by a trolley wheel, and the return current goes through the wheels and rails. A car can be ran from 3 to 5 feet per second, and as the ends of the track do not form a part of the circuit, the speed of the car is decreased when it reaches the end.

The International Tramways and Light Railways Exhibition which will be held in London, June 2 to July 4 of the present year, offers two prizes; one of $125 for the best device for securing a dry seat on the top of tram cars and omnibuses in all conditions of weather, and the other a prize of $125 for the most practical and efficient life-saving guard or fender for street railway cars. The competitors must offer a full-sized model and pay a nominal fee. Applications are to be sent to The Tramway and Railway World, London, not later than June 1.

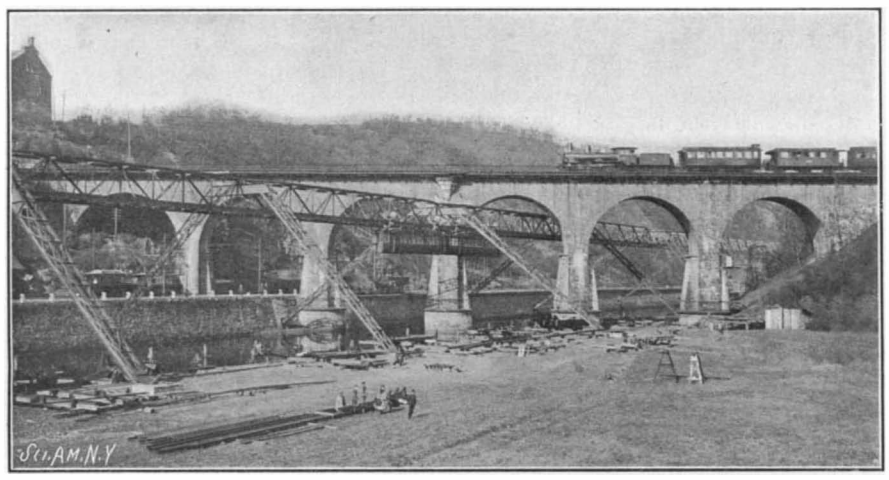
Liebenow considers that no attempts in the direction of making dry secondary cells are likely to be successful. Investigations into the action of the secondary cells have shown that there are electrical concentration currents set up, which tend to convey the acid in the pores of the plates from points of maximum to points of minimum concentration. These currents are necessary to equalize the strength of the acid, and effect this far more rapidly than would be done by diffusion acting alone. When a gelatinous electrolyte, or a dry non-conducting powder is introduced between the plates, this equalization is prevented and the cell is soon exhausted.

The Shawinigan Falls will be utilized for the purpose of generating electricity, which will be transmitted to Montreal for use. The works consists of a canal, flumes, etc., which will develop 30,000 horse power, and this amount can be increased if necessary. The current will be delivered to manufacturing establishments at Shawinigan Falls during the coming summer. The power will not be transmitted to Montreal until the spring of 1901. The transmission line will be a little less than 80 miles in length and will run along the Great Northern Railway, which is now being completed. At first 5,000 horse power will be delivered in Montreal and this amount will be increased to meet the demand.

M. Marcel Delmas, 10 Boulevard Emile Augier, Paris-Passy, has charge of the report of the "Congres de Mecanique de l'Exposition Universelle," in the department of applications of electricity to the various apparatus of haulage, hoisting, etc. (including cranes, elevators, winches, swing-bridges, pumps and other such mechanisms), and particularly desires information regarding the economic side of the matter. He requests that all, whether intending exhibitors or others, who are willing to assist in the collection of this data, send him, at the address given above, statements of costs of installations, of exploitation and incidental expenses; especially where a comparison can be made with costs of the older systems under similar circumstances. All publications, and illustrations will be welcome, if authentic and exact in statements of facts and **data.**

THE LANGEN SINGLE-RAIL SUSPENDED RAILWAY.

Among the many systems which have been proposed for the construction of a single-rail railroad, there is one which has been so far realized that it is to-day in partial operation, and is in a fair way to be completed. About half the system was in working order some twelve months ago, and the whole line, which



CONSTRUCTION BENEATH THE MAIN RAILWAY VIADUCT OVER THE WUPPER RIVER.

covers a total length of 8·3 miles, will be opened to the public during the present year.

We are all more or less familiar with the so-called single-rail systems which have in the past attracted attention, among which might be mentioned the Meigs system, the Lartigue, the Decauville, and that of E. M. Boynton, the remains of whose bicycle railway may still be seen in the vicinity of Coney Island, New York. Although the term single-rail is used in speaking of these railways, in reality they are dependent upon two, and in some cases, three rails for stability; for, although it is true that the carrying of the load is performed by a single rail, the designers have usually introduced one or more auxiliary rails, whose duty it is either to preserve equilibrium, as in the case of the Boynton railway, or to prevent oscillation, as in the A-frame system of Lartigue.

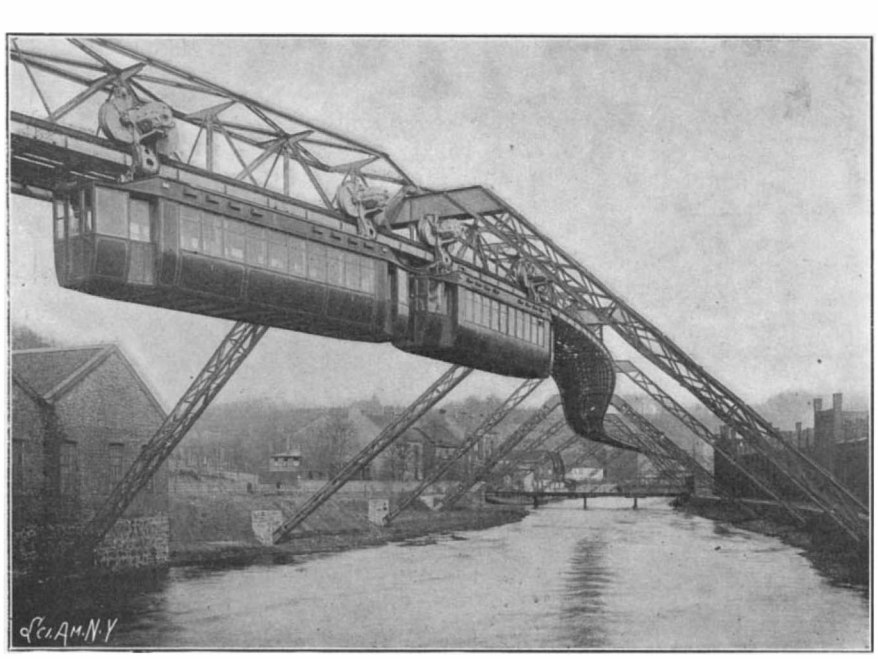
The Langen mono-rail railroad, which forms the subject of our illustrations, is named after its designer, Eugene Langen, who was led to turn his attention to the designing of a single-rail railway in the endeavor to overcome difficulties of transportation in connection with some sugar works, of which he was the owner. Strictly speaking, his system is the first to which the term mono-rail is applicable, for while it is true that the Decauville railway makes use of only one rail, in this case it is necessary that the cars be steadied by means of transverse shafts, which are supported by the operatives pushing the cars, or by the draught animals employed to haul them.

The railway under consideration extends between the towns of Barmen and Elberfeld, which are situated in the picturesque Wupper Valley. The superstructure, or railway proper, consists of a system of latticed longitudinal girders, one vertical and two horizontal, assembled into the form of an I-section, the main girders, forming the web of the I and the lateral girders, which give the necessary horizontal stiffness, serving as the top and bottom flanges of the I. Diagonal tie-rods extend from the upper panel points of the central girder to a connection with the chords of the bottom lateral girder. The last mentioned chords consist of steel I-beams, and upon their upon their upper flanges is laid the single T-rail, from which the cars depend and on which they run. The girders, which are generally of about 100 feet span, are carried upon two different styles of support. Where the railway is located immediately above the Wupper River, the A-frame style of pier is used, while in the suburbs of towns through which the line passes the trusses are carried upon large inverted U-frames. The A-frames consists of two rectangular, latticed struts, which are united at the top by a rectangular plate yoke.

The railway throughout its entire length is double-track, with a loop at each terminus. The maximum grade of the line is 4½ per cent., and the sharpest curves have a radius of 295 feet. It should be mentioned that in order to give the whole structure longitudinal stability, rigid double A-frames, with a broad, fixed base, are introduced at intervals of about 900 feet, the intermediate A-frames being provided with ball and socket joints. By this arrangement the intermediate posts, or A-frames, as the case may be, are free to move in a longitudinal direction and accommodate themselves to the expansion or contraction of the supported spans. The cars are suspended from two two-wheel motor trucks, which are attached to the roof of the car, one at each end, the distance between the trucks being 26¼ feet. The truck frame, as will be seen from the illustration, curves closely around the longitudinal I-beam upon which the track rail is carried, with a view to preventing the possibility of the wheels jumping the rail. The motor is carried on the outside of this truck frame and in position midway between the two wheels, and it receives the current by means of a slip-shoe and a contact rail, which is carried on the bottom of the lateral girder, a little to the inside of the main supporting I-beam.

The style of the cars is shown clearly in the accompanying illustrations. They can accommodate fifty passengers, and each car is divided into first and second class, and smoking compartments. The motors are of 36 horse power, and the maximum speed, between stations, is about 25 miles an hour. As it takes only about 15 seconds to reach full speed, the average speed, including stops, over the whole line, is about 19 miles per hour, and this in spite of the fact that there are eighteen stations on the road. The trains are ordinarily made up of two cars, but the station platforms are made sufficiently long to accommodate four-car trains whenever the development of traffic calls for them. As each car carries its own motor, the speed will not vary with the weight of the train. The system is fitted with an automatic block system, in which the signals are regulated by the car itself, and, consequently, the headway between the trains may be reduced, if desired, to two minutes. An efficient system of braking is used, chief reliance being placed upon the Westinghouse pneumatic brake, with which all cars are fitted. The speed may also be controlled by a hand brake connected up with the fittings of the Westinghouse brake, and also by an electrical brake; while an emergency stop may be made by reversing the motors.

In that portion of the line which is built above the river, the total weight of the structure, including the supporting struts, or piers, is less than 850 pounds to the foot, while the weight of the portion above the roadways, where the inverted U-posts are used, is 785 pounds. When we consider that the length of the spans averages about 100 feet, it will be seen that the structure has been designed with a due regard to economy of material. The cost of construction of the line was from $200,000 to $225,000 per mile, including the foundations and the stations. If we include the cost of the equipment, which provides a sufficient number of cars to allow the trains to be started at from two to three minutes intervals, the total cost per mile will be about $265,000.



A TWO-CAR TRAIN ON THE LANGEN SINGLE-RAIL SUSPENDED RAILWAY ABOVE THE WUPPER RIVER.

THE INVERTED U-FRAME PIERS USED ON SUBURBAN STREETS AND HIGHWAYS.

Purification of Acetylene.

Chromic acid may be used to advantage for the purification of acetylene, as has been shown by Ullmann and Goldberg. The phosphorus and sulphur contained in different samples of acetylene which had been purified by different methods were estimated by analysis, and the results show that ferric and chromic salts have no purifying effect upon commercial acetylene, and that cuprous chloride removes the hydrogen phosphide but not the organic sulphur compounds. On the other hand, chromic acid has been found to absorb not only the phosphorus compounds, but almost all of those containing sulphur. The results of their experiments show that pure acetylene is not attacked by the chromic acid solution, and that the quantity of the solution required to purify the gas depends only upon the quantity of gas to be treated and the amount of impurities it contains.

It appears from the observations made by F. B. Ahrens, that the mixture sometimes used to purify acetylene, made up of bleaching powder or other materials, gives off considerable heat and the action is accompanied by an evolution of chlorine. For instance, bleaching powder and sawdust are now used to remove the sulphur and phosphorus compounds present as impurities in commercial acetylene, and in this case it is found that the gas, after passing through the purifier, contains a large amount of a chlorine compound. Besides, after a short time, the mixture becomes strongly heated and loses its purifying properties. This result is not due to the action of acetylene on the mixture; this has been proved by the fact that when bleaching powder and sawdust are mixed with water, a considerable rise of temperature takes place. This is more or less rapid and is accompanied by the evolution of chlorine and water vapor in large quantities. That the action is due to the sawdust appears from the fact that when the latter is added to a cold solution of calcium hypochlorite the temperature rises to 95° after a short time. On the other hand, no change of temperature is observed when pure and finely divided cellulose is used in place of the sawdust. There is no doubt that it is the lignin of the latter substance, which reacts with the hypochlorite. This inconvenience resulting from the use of sawdust may be entirely overcome by mixing the bleaching powder with some inert substance such as infusorial earth, powdered coke, brick dust, etc.

Iodine in Sea Water.

In a contribution to the debated question as to the amount of iodine present in sea water, A. Gautier states that in the form of inorganic salts practically no trace exist in the water of the open sea. In the form of organic compounds, however, a considerable amount of iodine is found, amounting in an insoluble condition to 0·52 parts per million, and as dissolved organic iodine, 1·8 parts per million, giving a total of organic iodine of 2·32 parts per million.—Compt. rend., 128, 1079.

THE United States Marine Hospital Service has a new disinfecting steamer for use at Havana. It is named the "Sanator," and has a formaldehyde apparatus, sulphur furnace and bichloride of mercury apparatus. There is probably not a harbor in the world where a vessel of this kind is much needed as so Havana.

EFFECTIVE DITCH-DIGGING MACHINE.

Judged by the test that "handsome is that handsome does," the ditch-digging machine which, by the courtesy of John A. McGarry & Company of Chicago, we are herewith enabled to illustrate, is one of the most successful substitutions of hand for machine labor in excavation that have recently appeared. The company mentioned has recently been carrying out improvements on the Evanston Park addition to North Evanston, Ill., which involved the construction of several miles of sewer and water ditches; and in looking around for some more expeditious and less expensive method than that of hand labor in digging these trenches, they authorized Mr. Richard Dalton, of Willmette, to construct a ditch-digging machine for the purpose. Mr. Dalton had been experimenting for a considerable time with a mechanical ditch-digger, and the rough trial machine which was built for the contractors proved so satisfactory that it entirely superseded hand labor in such classes of materials as were suited to its operation. We are informed that, although it was somewhat clumsily built, as is evident from the illustration, the machine proved something of a revelation to the engineers of the city of Evanston, showing unexpected efficiency. The loosening up of the material is performed by a set of plows which are attached to pivoted arms on a heavy wooden wheel, 12 feet in diameter. The wheel is driven by a sprocket chain which is carried around a smaller sprocket wheel, keyed on the shaft of a portable engine which forms part of the machine. The plows referred to extend a little beyond the mouths of a set of buckets, four of which are carried on each side of the wheel. As the wheel rotates the plows loosen up the earth, which falls from the plows into the buckets as they rise from the bottom of the trench.

The buckets are carried at the outer end of the pivoted arms, the inner ends of which are attached near the axle of the wheel. During the part of the travel of the wheel in which the buckets are filling with the loosened material, the arms are locked, but when they reach a point a little above the level of the top of the ditch, the catch releases and they swing out on each side of the machine, and a little later in the revolution of the wheel empty their loads on either side of the trench. Further on in the revolution they are thrown back by their own gravity toward the wheel, and are automatically locked in position, ready to take up another load as they swing through the ditch. The machine is mounted upon low wheels, and it is moved forward as the digging proceeds by means of 300 feet of chain, one end of which is made fast to a post which is driven into the ground for the purpose, the other end being drawn in by means of an arrangement of ratchet wheels and chain pulleys, operated by the engine that drives the excavating wheel.

Provision is made for varying the width of the excavation anywhere between 30 and 72 inches, and this is done by placing liners between the tire of the wheel and the radial arms. By means of a rocker-arm mechanism which is pivoted on the road wheels of the ditcher the trench can be dug to any depth up to 8½ feet with a machine of the size shown in our illustration. Some idea of the remarkable capacity of the excavator may be gathered from the fact that when working in what is designated as a very tough kind of stony hard-pan, it has dug a trench 3 feet wide, 6 feet deep and 460 feet long, in a day of nine hours, only four or five men being required to operate the digger. This, it will be seen, approximates a rate of 1 foot per minute; and that this should be done under the supervision of such a small working force, shows that the machine is a great saver of hand labor. From the end view, showing the excavated trench, it will be seen that the ditch is cut with exact alignment and a fairly regular cross-section.

MACHINE FOR TRENCH AND DITCH EXCAVATION.

THE western oil district at Los Angeles shows a steady output, and we have been favored by a correspondent with an account of the remarkable increase in the wells, following the earthquakes in the vicinity of San Jacinto. The earthquakes occurred at Christmas, and resulted in the disturbance of a considerable area.

Aeronautical Progress in France.

The question of military ballooning has been made the subject of considerable study in the French army, and at the present time a very effective organization of this service has been established, this having been carried out on the lines of previous experience with the balloon in military work. This dates as far back as 1794, when, shortly following the celebrated experiments of Montgolfier, an aerostatic station was established at Mendon, near Paris. This was afterward renewed in 1878, and has now become the central aerostatic station of Calais. Besides this central establishment, a number of sub-stations and magazines have been established throughout the country.

END VIEW SHOWING TRENCH AND SPOIL BANKS.

The captive balloon of the regulation model is of spherical form and is divided into three categories: First, the normal balloon having a volume of 540 cubic meters, capable of carrying two aeronauts, besides ballast and accessories; second, an auxiliary balloon containing about 260 cubic meters, for one aeronaut; lastly, balloon-gasometer, used to carry a reserve of 60 cubic meters of gas. Besides these forms, some of the stations on the frontier are provided with material for making free ascensions, consisting of a balloon of 900 cubic meters, which is inflated with illuminating gas or hydrogen. For the envelope of the captive balloon, the best material has been found to be Chinese pongee silk, which is a tissue both light and flexible; it is made impermeable by a special varnish, this being very adherent and not attacked by the air; it besides does not injure the fabric to any extent.

The sphere of the balloon is made up in the usual way by segments, and at the bottom is a kind of sleeve used in filling it. At the top is placed a valve of special construction, designed by Col. Renard, which permits the areonaut to let the gas escape progressively and in the desired quantity, in the case of a slow descent, or, on the contrary, to rapidly empty the balloon in case a grave accident makes it necessary to descend quickly. The network of cord of the usual form, supports the basket, which is made of osier, well consolidated and made indeformable by a frame work of iron and hardwood. It is arranged for two men, besides the ballast and the different instruments and appliances, among which may be mentioned a combined ladder and anchor. This consists of a metallic folding ladder carrying at intervals a kind of grapnel designed to catch upon the ground. When unfolded, the ladder has a length of 5 meters; it is used especially for landings which are attended with some risk. This event must be provided as the balloon may break its attaching cable and make a free ascension. The cable used is of steel, especially constructed for lightness; it weighs only 115 grammes per meter, and on account of its small weight a height of 1,000 meters may be given the balloon. The cable is rolled upon a revolving drum, operated by a horizontal steam engine which controls the maneuvers of mounting or descent. The drum and engine are installed upon a vehicle adapted for the purpose, and the balloon may be thus towed behind a column of the army on march.

For the inflation hydrogen is usually employed. At the Calais station a process has been designed for its rapid production by passing a current of acidulated water over zinc turnings. Nevertheless, although the process is simple and cheap, it has the great inconvenience, for military use, of requiring an installation which, although portable, must be followed by the necessary supplies of acid, water, metal, etc., and besides, it takes a certain time to produce the gas in this way. This difficulty is avoided by conducting, behind the balloon, the hydrogen compressed in steel tubes provided with a stop-cock, at a pressure of 200 atmospheres. The tubes are carried on a wagon assigned for the purpose, which takes eight tubes as a load. It requires sixteen tubes for the normal charge of a balloon, and to give an idea of the rapidity of this method, the results obtained at the time of the annual maneuvers may be cited. The aerostatic section arrives at the point decided upon for the ascension, the balloon is equipped, inflated, provided with its basket and connected to the windlass upon the vehicle, ready to ascend, all these operations being carried out in half an hour.

The aerostatic equipage designed for use in time of war is placed in the different engineering establishments of the army and at the central post of Calais. It is distributed in a certain number of aerostatic parks, specially equipped for the purpose. A park of this kind includes two balloons of normal type, one auxiliary balloon, a windlass vehicle, a tender for the engine, a wagon for the accessories, and six tube wagons. The personnel consists of a certain number of sections of field aeronauts, each section having three officers and 78 men. The first four regiments of military engineers have each a company of aeronauts, and these are designed to furnish the field sections, as well as those required at the magazine stations, etc. The central establishment of Calais has the general supervision of this department of the army, and is charged with the construction and keeping in order of the balloons, as well as the study and experiment relating to aerial navigation in general. A series of experiments is now being carried on under the supervision of a corps of officers who have made a special study of the question and to whom are due a number of inventions and ingenious dispositions which have contributed to the successful operation of the system.

IN breaking calcium carbide small pieces are apt to fly into the eye. As calcium carbide is decomposed by water it becomes very hot in doing so and yields slaked lime as a product. Should an accident of this kind happen it has been suggested that the eye should be wiped out with oil, or with a solution of sugar. This advice is not particularly good, however, and probably the most efficient means of cleaning the eye is to use large quantities of tepid water. The sufferer should plunge his head into a pail of water and open his eye if necessary, and if the pain is so great that he cannot open it very well, it may be stretched open with the fingers. Absolute cleanliness is very important.

Deep Bore Holes and Shafts.

The deepest oil well which has yet been sunk in this country is about twenty-five miles from Pittsburg in the valley of the Monongahela River. A few months ago the hole had been drilled to a depth of 5,532 feet, and then work was suspended on account of an accident, owing to a break in the rope, a thousand feet of it, with the tools, dropped to the bottom and at last accounts men were at work fishing for the lost supplies, says The New York Sun. It is intended to sink the well to a depth of 6,000 feet. This breakage is the chief difficulty in the way of making deep borings. When the artesian well was dug at Grenelle, Paris, a length of 270 feet of boring rod broke off, and fell to the bottom of the hole after a depth of 1,254 feet had been reached. It required nearly fifteen months of constant labor to pick out the broken parts, and the drilling could not, of course, be resumed until they had been removed. At present there are only two borings in the world, which are any deeper than the Monongahela one and they were both sunk in Germany at the expense of the government to ascertain the thickness of the coal measures, and the greatest depth was obtained at Paruschowitz, in Upper Silesia, where the diamond drill has penetrated to the enormous depth of 6,570 feet, and the second is near Schladebach near Leipsig. The following is a list of the deepest bore holes.

	Feet.
Paruschowitz, Upper Silesia	6,570
Schladebach, near Leipsig	6,265
Monongahela (thus far sunk)	5,532
Wheeling, W. Va.	4,920
Sperenberg (gypsum beds near Berlin)	4,559
Lieth, near Altona	4,388
Eu, near Stassfurt	4,241
Lubthen, in Mecklenburg	3,949
St. Louis, Mo.	3,843
Sennewitz, near Halle	3,644
Inowrazlaw, Posen	3,424
Friedrichsaue, near Aschersleben	3,542

Most of the artesian wells in this country vary from 200 to 1,000 feet in depth, and the average depth of those sunk for irrigation in the western part of the country is 210 feet. When shafts are considered this country has the deepest. One on the Houghton Peninsula was begun in 1895, and will not be completed until 1901. This will be the deepest shaft in the world, and will take that distinction away from the Red Jacket vertical shaft of the Calumet and Hecla mines, which is less than a mile away. This shaft is 4,900 feet deep.

The Solubility of Argon and Helium in Water.

Mr. Estreicher has recently published an account of a series of researches which he has made in order to determine the solubility of argon and helium in water. The value given by Mr. Ramsay, in his preliminary note published in 1895, for the coefficient of solubility of helium, makes this to be 0·0073 at 18°C, showing it to be one of the least soluble of the gases, but as a result of further experiments, Mr. Estreicher considers that this coefficient should be doubled or nearly so. The apparatus he uses is the same in principle to that devised by Ostwald, but has two considerable improvements, one of these consisting in the employment of a glass spiral to unite the recipients of measure and absorbtion, which permits him to make the apparatus entirely of glass, and the whole instrument can be immersed in the water. This envelope of water permits the determination of the exact coefficient of solubility at temperatures varying from 0° to 50° C. He has plotted his results in the form of a series of curves side by side with the curve of nitrogen for comparison. The curve of the solubility of argon is of the usual type, with a decrease as the temperature raises, the value ranging from 0·0578 for 0° C. to 0·02567 for 50° C.

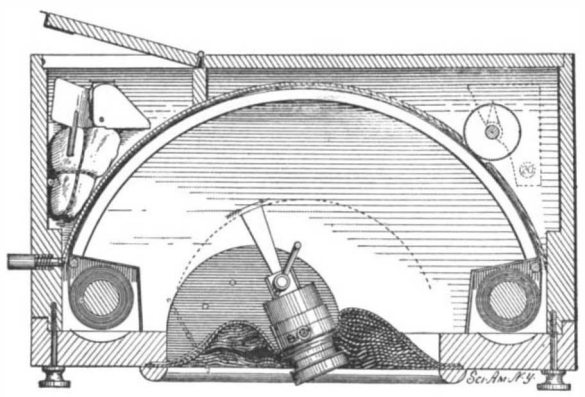
The solubility of helium varies but slightly with the temperature, and the curve shows a minimum near 25° C, the values being 0·015 for 0° C.; 0·01371 for 25°; and 0 01404 for 50° C. The curves of nitrogen and of helium cross at about 30° C, this being the temperature at which they have the same solubility. Above this temperature, nitrogen becomes more soluble than helium.

THE German Archæological Institute at Athens has just celebrated the twenty-fifth anniversary of its foundation, and the celebration was held in the presence of a number of members of the royal family of Greece. Addresses were made by Prof. Dörpfeld, M. Homolle and other archæologists. During the last quarter of a century the German Institute in Athens has rendered immense service to the cause of archæological science conducting researches at Menidi, Tegea, Corinth, Sunium, Thebes, Mitylene, Paros, Athens and Megara, besides participating in important excavations at Olympia, Troy, Tiryns, Orchomenus and elsewhere.

A CONVENIENT PANORAMIC CAMERA.

The amateur photographer, equipped with the ordinary 4 by 5 camera, many times sees, in the course of his excursions, opportunities for securing pictures embracing a wider range of view than his camera permits, and generally arranges the instrument to rotate in such a way as to take a succession of separate views, covering an area of 180 degrees; then, by joining the finished pictures in line together, a panoramic view is obtained. A picture of this kind requires a nicety of manipulation in matching to obtain satisfactory results, otherwise the joints will appear too prominent and render the scene imperfectly.

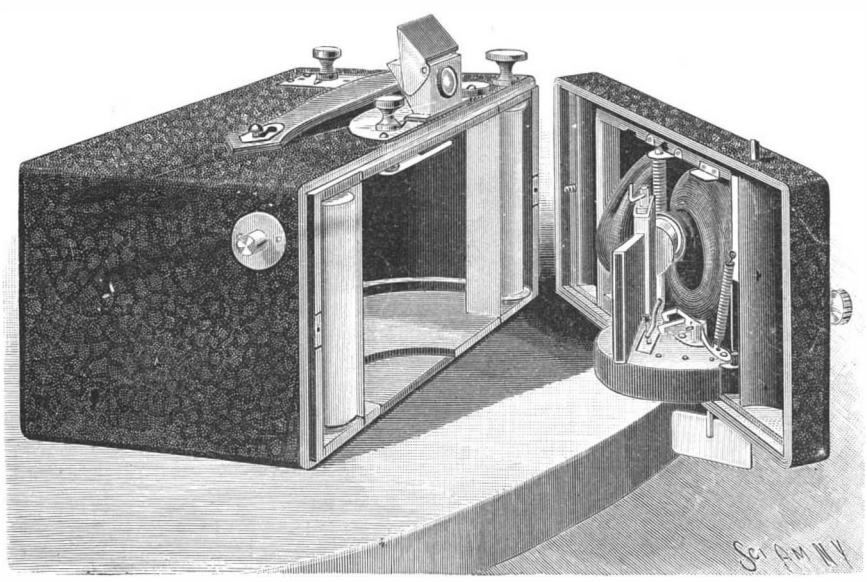
Since the advent of the rollable film and the subsequent improvement known as a daylight cartridge film, different forms of cameras have been devised for making panoramic pictures. Our illustration is a type



SECTIONAL PLAN OF PANORAMIC CAMERA.

of one of the latest styles of a panoramic camera called the "Al-vista," just introduced by the Multiscope and Film Company of Burlington, Wis., embracing several improvements which make it very convenient and adaptable for several purposes; at the same time it can be easily and rapidly operated, loaded and unloaded.

The camera is made in two principal parts: first, the lens board, or front, and lens-moving mechanism; and second, the back or box for holding the film, film spools, film punching and registering device, lens index, stop arm, finder, and level. This construction enables the operator at will to take a picture of a uniform width of 4 inches to 4, 6, 8, 10, or 12 inches long. The lens supplants the ordinary focal plane shutter by itself rotating over a half circle and throwing the image 4 inches wide by 12 inches long upon the semi-circular film in the rear. It is pivoted rigidly midway between the front and rear lenses to a vertical shaft operated by clockwork mechanism observed in a casing below the lens, and is protected by a flexible leather front. A flaring radial rectangular tube about 2 inches long projects rearward from the lens tube and carries the picture rays from the lens in the form of a narrow strip of light, something like the flash of a lighthouse lamp, continuously along the rear circular



A ROLL HOLDER FILM PANORAMIC CAMERA.

sensitized film. So it is only necessary to control the extent of the revolution of the lens to determine the length of the picture desired. To set the lens, the key seen underneath is rotated, which in turn winds up the clock spring and turns the lens in the opposite direction until it is held by the release lever. At the rear of the lens tube is a small shutter whose projecting arm at the top is arranged to impinge against the stop plate arm to be seen just under the center of the top of the film box. This has an index pointer on the outside and can be quickly adjusted by rotating the knob with fingers. If an exposure 6 inches long is desired, the pointer is set at figure 6; when the lens is released, it rotates until the arm of the shutter strikes the stop arm and thus only exposes a 6-inch section of the whole film. The finder is supported upon a revolvable plate, also having an index pointer, and this is set at the figure 6 so that the image viewed in it will be parallel to that covered by the lens. Adjacent to the finder is a circular level. A shaft from the clockwork mechanism projects slightly through the bottom of the lens board, or front, and to this may be attached different sized flat pieces of metals which act as fans and regulate the different speeds at which the lens can be made to rotate. There is also provision made for inserting different sized stops in the lens.

The sensitized film spool is put in the extensible spool holder on the left hand and carried over a guide roller and on through the semi-circular channel to the other end, where it is wound up upon the winding spool, against a suitable tension plate. The thumb screwhead for operating this spool is seen on the right hand end. In its movement the film also operates an index cylinder, which tells at the top the number of inches of film reeled off, then on the left is a punch button for punching a hole through the film after each exposure, as a guide to the separation of the pictures.

The lens front is secured to the film box by two thumb screws, one at each end. Every part is accessible, and the matter of friction in the free movement of the lens is reduced to a minimum. The camera is intended to be supported on a tripod, but is provided with a handle, and in emergencies can be held on the arm during exposures.

In an exposure without any fan attached, the lens rotates from one side to the other in 1½ seconds, causing the image to travel over a space of 12 inches, thereby giving one-sixth of a second stationary exposure. Fans lengthen the exposure ¼, ⅓, ⅜, ½ seconds, according to size used. In the rear is a compartment for holding the finder, fans, stops and extra spools of film.

From what has been said it will be noted that the camera is a very useful instrument, in view of the fact that panoramic or smaller sized pictures, time or instantaneous, can be quickly and easily made, according to circumstances.

A New Ore of Nickel.

A new nickel, believed to be of great commercial value, has been discovered in the copper ore district of Houghton, Mich. It has been named Mohawkite, from the mine in which it was found. It was at first supposed to be a copper sulphide, but chemical examination indicated that it was a new mineral. It possesses a silvery metallic lustre when freshly broken, with very irregular fractures. Chemical analysis shows that it is an arsenide of copper, similar to the domeykite, in connection with which is also found an arsenide of nickel. The possibilities offered by this combination are very great. Copper is more than ever a valuable metal and is now commanding a high price, and nickel is now used in a large number of industries where twenty-five years ago a few tons only were used, in the subsidiary coinage of the United States, so that the discovery of new ores and new bodies of an ore of nickel, may be regarded as of the greatest possible importance. It is, however, in the field of alloys that Mohawkite will probably be more valuable. The assays, so far as determined, reveal an almost ideal composition for an alloy of copper and nickel, for which there is already a good demand. The new mineral can also be turned into commercial products from the ore almost without waste.

The International Photographic Congress.

The Committee in charge of the International Photographic Congress which is to be held in Paris, has recently established the following programme of the questions to be considered.

1. Photographic plates, classification and sensibility in various conditions of use. 2. Photometry; the practical study of the subject as applied to photography. 3. Characteristics and classification of optical glass. 4. Lenses and diaphragms; systems of numbering. 5. Questions relating to photographic shutters. 6. Classification of glass plates used in photography as to thickness. 7. Dimensions of cinematograph bands. 8. Expression of photographic formulæ. 9. Project for decimal classification in the bibliography of the subject. 10. Legal protection. 11. Proprietary rights and licenses. 12. Questions relative to photographic documents and archives.

If it is desired to communicate any documents or researches relating to these or like subjects, a resumé should be addressed to the secretary of the committee before the 15th of June in order that it should be admitted to the sessions of the congress. The secretary, M. S. Pector may be addressed at 9 Rue Lincoln, Paris.

AN exhaustive exhibit of United States postage stamps will form a part of the Paris Exhibition. It is said to be one of the most complete ever made, embracing every variety issued since the inauguration of the postal service.

The World's Shipping.

The following figures show the condition of the merchant marine of the different countries, including steam and sailing vessels, at the end of the last year. The first table gives the gross and net tonnage of the steam vessels.

	Number.	Tonnage, Gross.	Tonnage, Net.
England	5,453	11,094.000	6,759,000
Germany	900	1,873,000	1,167,000
France	526	986,000	517,000
America	551	971.000	673,000
Norway	657	673,000	417,000
Spain	377	552,000	350,000
Japan	332	456,000	283,000
Italy	258	443,000	278,000
Russia	435	408,000	252,000
Denmark	318	389.000	238,000
Holland	224	366,000	251,000
Sweden	497	340,000	232,000
Austria	167	335,000	213,000
Belgium	73	147,000	103,000
Brazil	211	140,000	90,000
Greece	108	140,000	91,000
Turkey	79	78.000	47,000
Argentine Republic	68	52,000	38,000
China	38	56,000	36,000
Portugal	29	54,000	33,000

By adding those of several of the other powers not given, a total of 11,456 vessels of more than 100 tons gross is reached, making a total of 19,771,000 tons gross, or 12,165.000 tons net.

The following table shows the number and tonnage of the sailing vessels.

	Number of Vessels.	Net Tonnage.
England	7,706	2,662,000
America	3,497	1,292,000
Norway	2,306	997,000
Germany	981	548,000
Italy	1,557	492,000
Russia	2,455	473,000
France	1,371	309,000
Sweden	1,423	277,000
Turkey	1,380	262,000
Greece	972	197,000
Spain	1,052	152,000
Denmark	752	138,000
Holland	663	118,000
Brazil	364	80,000
Chili	132	60,500
Portugal	237	60,430
Austria	142	49,300

By adding several of the smaller powers, a total of 27,867 sailing vessels is reached, the list including those of more than 50 tons capacity. The total tonnage, net, reaches 8,347,600 tons.

A Prize for Aeronauts.

We have already referred to a very substantial prize for a practical airship which has been offered in France. We have received some additional particulars regarding the same, furnished by our Paris correspondent. The prize is offered by M. Deutsch, a Parisian, who has always been specially interested in aeronautics and automobiles. After mature consideration, M. Deutsch decided to encourage the building of dirigible balloons which would be propelled with light motors. The prize is 100,000 francs, or $20,000, and it is offered to anyone, irrespective of nationality, who will make a trip in a balloon or airship from the park of the Aéro Club, or from Longchamp, to the Eiffel Tower and return to the point of departure in half an hour. The prize must be won within five years. The Aéro Club will have charge of the competition. The prize will be known as the "Grand Prix de l'Aéro Club." Aeronauts who enter into this competition are expected to provide new inventions to enable them to accomplish this feat, and dates will be arranged for a practical test of such apparatus as is considered good. The conditions of the prize are now being formulated, and we hope to be able to publish them at an early date.

Lithographic Stone in Germany.

The territory in and around the village of Solnhofen, in the Kingdom of Bavaria, forms the world's chief supply of lithographic stone. The quarries near Montpelier do not compare with those at Solnhofen. There are three villages surrounding the German quarries. They cover a considerable area, the greater part of which has not yet been worked out. It is often given out that the supply of Solnhofen stones is diminishing, but this is without foundation, and it would probably take about 200 years to exhaust the quarries. It is constantly rumored that lithographic stone beds have been found in other countries, but so far the stones have been of little value, and the present requirements of the art are that the stones must be very perfect, and many of the pieces which are gotten out at Solnhofen are laid aside as not coming up to the standard. They are sold to builders and are used for paving, etc. The strata of lithographic stone does not lie deep in the ground. The stone lies in layers and have simply to be taken carefully from the earth. The majority of the deposit belongs to the communities of Solnhofen and Moernsheim and, therefore, each homestead owner has a share in the ground. From time to time the committees measure out a new stretch of land and divide it into lots, and each homestead owner gets his share. He can then either explore the ground himself, or sell his claim. After the ground has been denuded of its stone it again becomes the property of the community. One would naturally suppose that these communities would wax rich, but this is not the case, as they often undersell each other, and the result is that the profits have been modest. In January, of last year, a combination was formed and more satisfactory prices are now being received. The stone which is in the greatest demand is the blue or gray variety. They are the most costly, as they are harder and better for engraving and more impressions can be taken from them, and, being harder, they stand the polishing on both sides better than the other stones, and, therefore, are chiefly used for exportation to the United States, where double-faced stones which can be worked from both sides are desired. The Germans are wont to use the single-faced stones. The workmen in the village are highly skilled in getting out the stones and no bad ones are apt to leave their hands. The entire output is estimated at $600,000 per year. The United States takes about a sixth of the stones.

The Current Supplement.

The current SUPPLEMENT, No. 1270, has many articles of unusual interest. "The Orang-Mammas—An Unknown Sumatran Tribe," is a profusely illustrated article showing the types of natives and their manners, customs and industries; "The Bollée Voiturette" is an elaborate article giving detailed illustrations of the working parts, such as the carbureter; "The Use and Abuse of Food Preservatives" is a timely article by Samuel Rideal. The number is illustrated by thirty-three engravings.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

PLOWSHARE.—ELMER E. MORRIS, Sarcoxie, Mo. The object of the invention is to constrnct a plowshare so that it will be self-sharpening and so that the cutting edge can be adjusted forwardly and rearwardly and likewise in a vertical section to a limited extent. The share has an intermediate blade-section provided with a cutting-edge, and capable of being reversed. When the lower portion becomes unduly worn and dulled, the share can be reversed, so that the worn portion is brought to the top and the unworn top portion brought to position at the bottom of the share.

Electrical Apparatus.

SWITCH.—JAMES I. GUNTHER, Manhattan, New York city. The switch comprises a rotary part carrying a ratchet-wheel which can be engaged by a push-button. A spring-pressed impelling device engages the ratchet-wheel, and contact-plates are provided on the rotary part. By pushing the button, the ratchet-wheel is given a quarter-turn, the button being assisted by the impelling device. The circuit is then closed. To break the circuit the button is again pushed to give the wheel a quarter-turn. The switch is positive and quick in its action.

Mechanical Devices.

MACHINE FOR PARING FEATHERS.—JOSEPH LOCH, Brooklyn, New York city. The feathers are drawn over a bed constructed in sections vertically adjustable, one section being also laterally adjustable. A paring-wheel is mounted to revolve below the section of the bed, a portion of the periphery of the wheel being exposed at the space between the sections. A combined guide and pressure roller is movable to and from the exposed portion of the wheel. In operation it is necessary merely to raise the roller, place a feather upon the bed, drop the roller on the feather, and draw the feather out from the machine. The operation can be repeated very rapidly, and a large number of feathers can be properly treated in a short time.

GLASS-PIPE-MACHINE.—WILLIAM P. PARSONS and ANDREW TUITE, Albany, Ind. The pipe-machine comprises a mold in which a core moves, having longitudinal passages, one for conducting water and the other air under pressure. The air-passage leads out through the ends of the core. Compressed air is supplied to the mold below the lower end of the core. The molten glass is poured into the mold, and water is poured into the proper passage to keep the core cool. The core is then slowly raised and compressed air is admitted to the bottom of the mold, which, by filling the space left by the core, keeps the glass in shape while the core is being withdrawn.

CHANGE-MACHINE.—CHARLES H. ROW, Manhattan, New York city. This machine is provided with individual compartments for coins of different denominations, each compartment being independent of the others, and having a hinged section capable of exposing the interior, together with an independent extractor for the discharge of the coins. The coins placed in the coin receptacle automatically form a column. The receptacles are so mounted that, when touched, they will swing upon their axes in the direction of the coin-discharging mechanism, which mechanism at such time forces a single coin out from the operated receptacle.

KNITTING-MACHINE.—MAX SALDIN, Manhattan, New York city. The invention is an improved attachment to straight knitting-machines, whereby mittens, sweaters, gloves, etc., can be knit so that either a singular tubular portion of the article or separate tubular portions can be knitted at the same time. For example, in a mitten, the wrist portion can be knitted, then the thumb and fingers simultaneously; or, in the case of a sweater, the body portion can be knitted, then the two sleeves simultaneously, and, finally, the remaining body portion to complete the garment, with the crotch at the joint of the single tubular portion, and the separate tubular portions knitted and closed automatically.

Railway-Appliances.

CAR STEP.—NELSON GRAY, Louisville, Ky. This invention is an improvement in car-steps of a type previously patented by Mr. Gray. The subject of the present invention is a folding car-step section, pivotally supported and provided with a platform-section arranged approximately at right angles to the treads of the steps and adapted to form an extension of the platform when the steps are adjusted out of position for use. The vestibule door is provided near its swinging edge with a depending portion arranged to bear upon the step-section and lock it in position for use. A latch is used by which to brace the vestibule-door in position to lock the step-section in position for use.

CAR-HOLDER.—LEE G. REPASS, Cripple Creek, Colo. The object of the invention is to provide a holder for securely holding the truck of the car in position on the rails, while dumping the contents of the car-body. A pair of curved, parallel hooks extend in a vertical plane and in longitudinal alinement with the track-rails and are arranged for removable connection therewith. The hooks are adapted to receive the treads of a pair of opposite car-wheels, to hold them to the track against upward movement.

LOCOMOTIVE BUFFER-BEAM.—JAMES F. DUNN, Salt Lake City, Utah. The buffer-beam has an unbroken top wall, unbroken front and back walls of rolled or pressed steel. The front and back walls are riveted to the top wall. Webs are secured within the beam between the front and back walls to prevent the collapse of the beam. Two steel plates at the ends and bottom of the beam are riveted to the front and back walls. The beam is strong, yet light. The boiler-front, cylinder-heads, and other vital parts of a locomotive are protected in case of collision.

Miscellaneous Inventions.

PANORAMIC CAMERA.—MELVIN T. STOWE, Mobile, Ala. The chief feature of the improvement is a flexible or, more properly, an elastic, adjustable holder for the sensitized film and the ground film upon which the image is focused, whereby the image thrown on the film by the lens may be rendered sharp at every point. Such a holder is particularly useful with a lens adapted for adjustment of focus corresponding with the distance of the camera from the object. The invention is a departure from most similar apparatus, in so far as the camera can be focused to produce a perfectly sharp image.

REVOLVER.—CHRISTOPHER D. MCDONALD, Vance, Colo. The purpose of the invention is to provide means for breaking or opening the arm and ejecting the empty cartridge-shells from the cylinder, to the end that reloading can be quickly and easily effected. The handle portion has an upper and lower extension, between the forward ends of which the barrel carrying the cylinder is hinged to swing sidewise. A spring-seated locking-bolt locks the barrel and handle, and cam-lugs draw the parts together when in closed position.

WAR-SHIP.—GEORGE W. VAN HOOSE, Tuscaloosa, Ala. In engaging an enemy upon one side a large proportion of the guns of the battery of a war ship must necessarily remain inactive. If the heavy guns could be arranged so that all could be concentrated upon an enemy on one side, the efficiency of a vessel would be greatly increased. The inventor has endeavored to attain the desired end by a construction of rising-and-falling and rotating turrets, so that the guns therein contained have two planes of fire, the lower plane being the normal position when the guns are trained away from the center of the ship, and the upper plane of fire being above and across the upper works.

ARTIFICIAL COMB-FOUNDATION.—HENRY VOGELER, Newcastle, Cal. The artificial comb-foundation has its cells constructed with thick beads extending around and constituting their rims or edges. Experiments have shown that bees require as long a time to make one pound of comb as to make ten pounds of honey; and this provision of surplus wax at the points most available for use by the bees is, therefore, of great importance, since it adds to the time available for gathering honey.

BUILDING CONSTRUCTION.—MARVIN H. JESTER, Manhattan, New York city. This system of construction embodies improved means of forming the floors and ceilings, such means being also adaptable to the building of walls or partitions of the building. Strong main beams are provided, on the lower flanges of which cross-ties rest, extending from one beam to the next. Hangers are secured to and depend from the cross-ties, and straps are fastened to the lower ends of the hangers, each of the straps extending across from one hanger to the next.

PROCESS OF MAKING LUBRICANTS.—JAMES M. JEWETT, Norfolk, Va. The process consists in mixing fat and soap under the application of sufficient heat to cause the mixture to melt or dissolve, adding thereto resin at a temperature of about 225° F., and then adding peanut-oil after discontinuing the application of heat. The lubricant keeps well, is not adhesive, and has great heat-absorbing or cooling power, rendering it particularly applicable to bearings.

TWINE-CUTTER.—CHARLES E. MCLAUGHLIN, Kanawha City, W. Va. The cutter is of that class designed to be worn upon the fingers. One of the objects of the invention is to construct a holder for the knife, so that it can be worn upon the third and fourth fingers, without interfering with the use of either and leaving the thumb and the other fingers perfectly free. The blade is so shaped and fitted in the holder that twine of large or of small size can be cut with equal ease and rapidity.

DRAWING IMPLEMENT.—ARTHUR L. PATTERSON, China Grove, N. C. This drawing implement is designed to enable a draftsman to draw ellipses. The implement comprises a string, a ruler, two clips adapted to be slipped on the ruler (each being provided with a string-clamp), a ruling-pen, and a plate adapted for attachment to the ruling-pen and provided with a passage-way for the string.

ROPE-TIGHTENER.—CARL A. BERTRANG, Brooklyn, New York city. The rope-tightener is triangular in form. A lever is pivoted to one angle of the frame, the lever having one end extending outwardly and being arranged for the attachment of a rope. The inner end of the lever forms a clamping end or dog. Clamping-pulleys are journaled at the other angles of the frame, so as to coact with the dog. With this device it is possible to take up the slack in the rope, and yet quickly free the rope when it is desired to slack off.

WATER-COLOR BOARD.—LOUISE H. COLLINS, Manhattan, New York city. The board is provided at one edge with two hinged, adjustable legs which rest on the ground, while the board itself is supported by the lap of the artist. A slide is provided, on which a tray or case of colors can be placed. The entire board can be readily folded and transported. A board of this kind can be very compactly, strongly, and yet lightly constructed, so that it can meet all the requirements of an artist who desires to work in the open air.

GAME APPARATUS.—DALTON DORR, Cynwyd, Penn. The invention provides a game apparatus in which triangular spaces are employed, having sections differing in color, so that a number of pieces can be arranged in different ways to produce a great variety of geometrical designs. The inventor sometimes combines with this feature an arrangement of pips or dots, by which the blocks or pieces are adapted for use in a game similar to that of dominoes.

Designs.

HANDLE FOR SPOONS, FORKS, LADLES, ETC.—AUSTIN F. JACKSON, Taunton, Mass. This patent presents a new design for the handles of forks, spoons, and the like, and provides ornamentation both unique and artistic in character.

HORSESHOE.—WILLIAM VELDEN, New Orleans, La. The feature of this design consists in interrupting a side outline of the horseshoe at the heel and connecting the interrupted portion with the heel at the opposite side of the shoe.

COIN-MAT.—HIRAM C. UNDERWOOD, Metuchen, N. J. The leading feature of the mat consists of depressions, rises, and saddles, whereby a coin can be conveniently picked up with gloved or ungloved fingers.

TROUSERS-HANGER.—ARCHIA L. ROSS, Manhattan, New York city. The hanger is made of a single piece of wire, having pairs of downwardly-extending loops and a separating-bar between adjacent pairs of loops. The loops receive the trouser buttons. The hanger can be so adjusted that several pairs of trousers can be secured to the loops.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

SCIENCE SETTLES A GREAT PROBLEM.

"Sober, he was the brightest, the most efficient, the most valuable man in his line I ever knew." Who has not heard this little tale from a dozen of his business acquaintances? What employer of skilled labor, of clerks, accountants or salesmen, has not told it regretfully over and over of some prized helper, on whom he had come to depend? So common is this story, that one might excusably infer some law of nature condemning the uncommonly proficient to inebriety. At any rate, the fact is there. Eight out of every ten business men find it their personal experience.

Probably the truth lies in this axiom of mechanics: That the more delicate and complex a machine is, the easier it is impaired. A man's efficiency is determined by the quality of his nerve force. The finer the quality, the better his work, and the greater his danger; especially his danger from intoxicants. Your unskilled laborer, working with his muscles, putting no thought into his work, is rarely a dipsomaniac. He may drink to excess periodically, he may be brutalized, coarsened thereby, and yet his efficiency, when sober, be not perceptibly impaired. His demand for stimulants does not, therefore, become constant and increasing. The man of more delicate nervous fiber—the more valuable man to society—meets with greater disaster. He is thrown further off, he feels it, he makes the effort to get back, and that very effort makes him feel more keenly than ever the need of artificial stimulus. The problem is too pathetically simple after that stage. The business man's little tale is the answer to it.

This drink-evil has never been without its earnest students. Good men and women have devoted their lives and means to the cause of temperance. Their method was that of appeal to the drunkard's reason. They preached to him that he was an immoral person and urged him to give up his wicked ways.

Have they succeeded? With no intention to disparage, with every appreciation for the nobility of their aims, with the concession, indeed that they have actually achieved no small result, it must still be maintained that in a broad sense they have failed—failed most lamentably. They have ably painted the drink-evil in its true colors, so that no intellegent man can to-day be ignorant of what excessive drinking will do for him. Yet, in spite of this presentment, men of the highest intelligence continue to go consciously along to the familiar doom. They know, yet do not stay. Why?

The old fashioned temperance worker says they will not. Science says they cannot.

Says the first: "They are wicked and perverse, deaf to the voice of reason, decency, self-respect, manhood. They do not exert their will." Says medical science: "They are not wicked, they are not deaf to reason nor to decency. They hear, they would obey, and they suffer the tortures of the damned because they cannot. They do not exert their will for a very simple reason; they have no will."

For the will is not an organ, be it understood, a tangible thing with which we are all equipped alike. It is a function, the function of the nervous system. When this system is impaired, will power is no longer generated.

Should you, then, continue to urge a man to use something which his impaired system has ceased to produce, or should you repair his system to that end? If the latter appeared reasonable, there would be a problem worth solving; one that would place the solver in the front ranks of genius and humanitarianism.

The problem presented itself substantially in these terms to one Leslie E. Keeley some thirty years ago. The son of a physician and the grandson of a physician, his bent was for medicine. He became himself a physician of the regular school. But from his early school days he had been especially interested in the phenomena of inebrity. It may have been a fad, at first. It became a life-work. Serving in the Civil War, where he rose to the rank of Major, he found abundant opportunity to continue his researches. When he settled down in Dwight, Ill., to the practice of his profession, the subject still mastered him. How were those unfortunates to be relieved? The old methods had failed. Was not a new method pointed to by the physiological facts? It became a suspicion with him, then a belief, then a conviction. The conviction once assured, he clung to it tenaciously. He searched, studied, investigated, experimented. For eighteen years he served his idea. Then he had his reward. His confident announcement to the world that drunkenness was a curable disease and that he had the cure for it in his treatment was of course scoffed at. But no new-discovered truth ever escaped this fate, so the scoffing had no effect on Dr. Keeley. He went about the work of demonstration with the same systematic methods that had brought him the discovery. He founded an institute for inebriates at Dwight, and the patients came. They were cured, to a degree that was at that time nothing short of miraculous. The news flew always. In a little time the institute at Dwight could not accommodate the half that would come to it. Branch houses were established. They were made neither hospitals nor prisons, but homes of the most homelike character. No locks, bars, or padded cells. Nor was the least restraint ever put upon patients beyond the request that they should not leave the town without permission, and that they would faithfully take the medicines prescribed. Neither were the patients treated as moral offenders, but the reverse. They were made to understand that they were all right, except for their disease, which was to be cured.

To-day there are sixty Keeley Institutes in the United States as against the single institute founded by Dr. Keeley, at Dwight, in 1891. These are bare, dry figures. Who can read in them the service to the nation, the family, and the individual, to the present and to all future generations. And to the familiar tale of the employer, "He was my best worker until he went to pieces from drink," may now be added a sequel if he wishes it: "Then I sent him to one of those Keeley institutes, because I thought it was a good investment; and it was. He came out a sound man, having neither desire, craving, nor necessity for stimulants. And if we would all learn to do this we would save a lot of good men that can't be duplicated."

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7881) F. W. G. asks: Can you give the chemical used to make paper such as was used in the old marking telegraph. The current was sent through the paper from two metal points (or point and plate) and discolored the part touched by the point. A. Make a solution of starch in hot water and put in a small quantity of potassium iodide, no exact proportion is necessary. Moisten a strip of paper with this solution. Place this paper upon a zinc plate which is attached to the positive pole of the battery. To the negative pole attach a wire which terminates in a platinum point. Draw or write with the platinum point upon the paper and the mark turns dark blue. The iodide freed by electrolysis colors the starch blue.

(7882) C. S. asks: What substances can be put in a full glass of water before it will flow over? Can this be found in your chemical department? I notice the water is above the glass rim and don't flow over. Why is this thus? A. A considerable quantity of salt, sugar, or any substance easily dissolved in water. Quite a large number of pins, bits of fine wire, a good deal of sand, or any fine powder not soluble in water. The level of the water is gradually raised till the surface tension of the water is broken by the pressure, and it then overflows the glass. The water will not stand so high above the rim of a clean glass as of one which has been rubbed by the fingers and is, for that reason, slightly greasy.

NEW BOOKS ETC.

MACHINERY FOR REFRIGERATION. By Norman Selfe. Chicago: H. S. Rich & Company. 1900. 8vo. Pp. 372, 213 illustrations. Price $3.50.

The author, who lives in Australia, is familiar with all types of refrigerating machinery, and has been connected with the subject since 1858. He has studied its progress both in the United States and Europe and, consequently, his book may be regarded as most authoritative. The mechanical processes carried out in ordinary refrigerating establishments are, compared with many others in which machinery is employed, exceedingly simple, but they are dependent upon principles which are not so easy to comprehend, and perhaps no branch of engineering has been less understood in the past by those who use machinery, than that which is connected with ice making and refrigeration. The only books, at one time, which threw any light on the subject dealt with it simply from a thermo-dynamic aspect, and their due comprehension required the reader to be a mathematician rather than a refrigerating engineer. The author has acquitted himself of a difficult task in an excellent manner. It is one of the best technical books we have seen in a long time, and it appears to be very thorough.

A TREATISE ON STAIR BUILDING AND HAND RAILING. By William Mowat, M.A., and Alexander Mowat, M.A. London: George Bell & Sons. New York: The Macmillan Company. 1900. 8vo. Pp. 368, 440 illustrations. Price $9.

In preparing this book the authors have done a signal service to architects and builders, for they have placed in their hands a complete course of construction in the principles and practice of stair building and hand railing, embracing all the technical information required in general practice. It contains numerous examples illustrating the construction of the various classes of wood stairs, both for house and passenger ships, and of stone stairs, with a complete course of hand railing, showing easy, accurate and economical methods of getting out and preparing wreathed hand rails. Also an appendix consisting of a short course of plain and descriptive geometry bearing on the subject. It is a most valuable book, and both the text and the illustrations are of high order. Stair building and hand railing are by no means easy subjects to master, and the authors have acquitted themselves of a difficult task in an admirable manner.

THE ROOF FRAMER; OR, THE SCIENCE OF ROOF FRAMING MADE EASY. Wheaton, Ill.: The Roof Framer Publishing Company. 1900. Very large quarto. Price $10.

A most valuable book for any builder, comprising a system of full-sized working scales for the rafter pole and prepared bevels, with specific instructions and a complete system of rules for getting anything required in roof framing. It is fully illustrated with engravings, diagrams, scales, etc. With the aid of these diagrams and instructions, which latter are couched in the working language of the trade, any good workman can do all the framing of the most complicated roof, on the ground, without drafting or scribing. It is an important contribution to the already full literature relating to building.

The Photo Miniature.—We have received No. 3 of this unique pamphlet form of literature devoted entirely to all that can be said on "Hand Camera Work" and also No. 4 relating to "Photography Out of Doors;" each are fully illustrated and contain useful information on the subjects mentioned. Tennant & Ward, publishers, 289 Fourth Avenue, New York.

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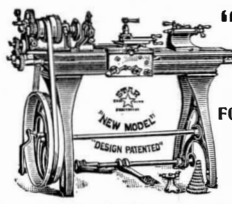

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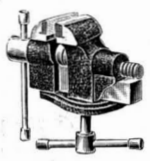

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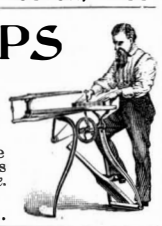

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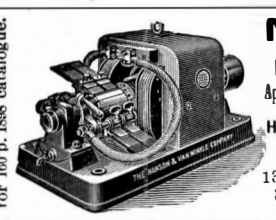

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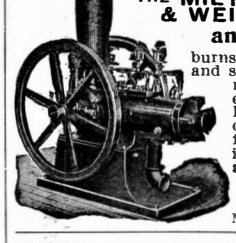

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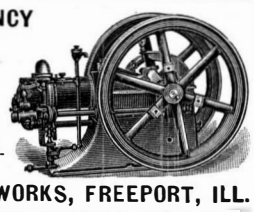

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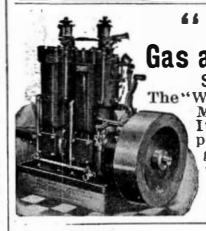

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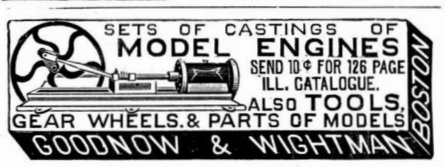
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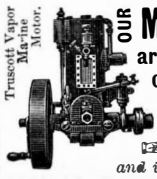

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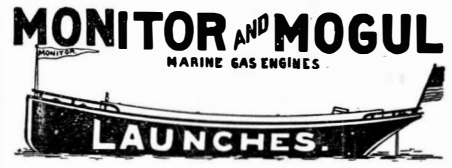

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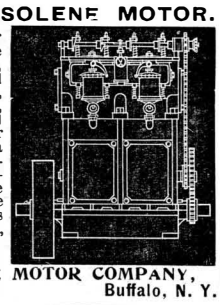

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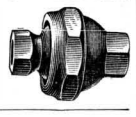

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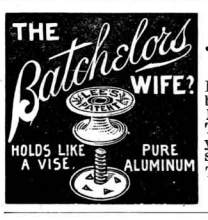

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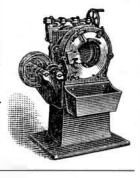

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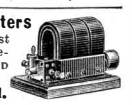

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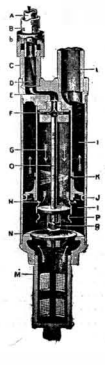

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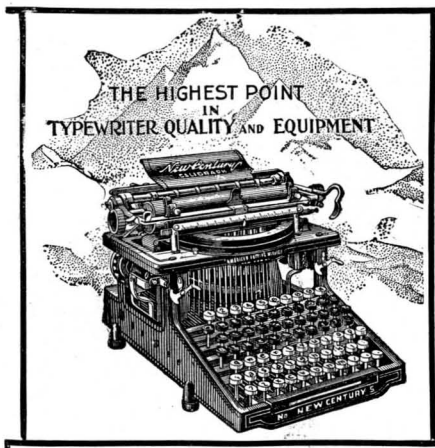

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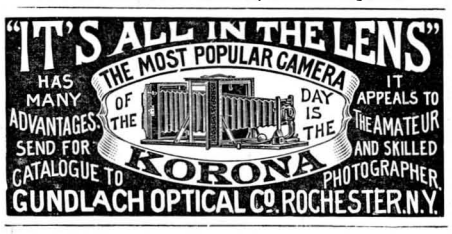
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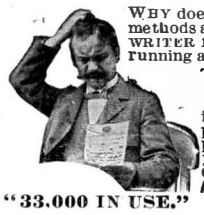

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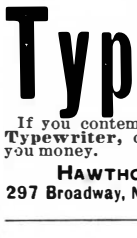

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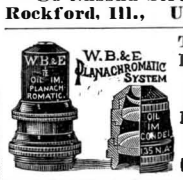

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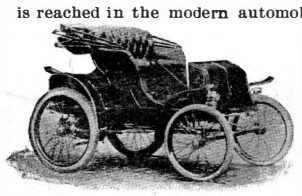

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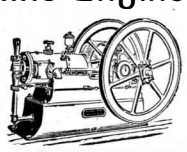

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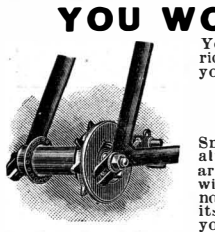

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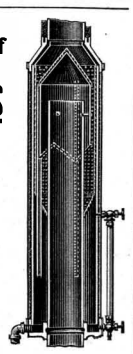

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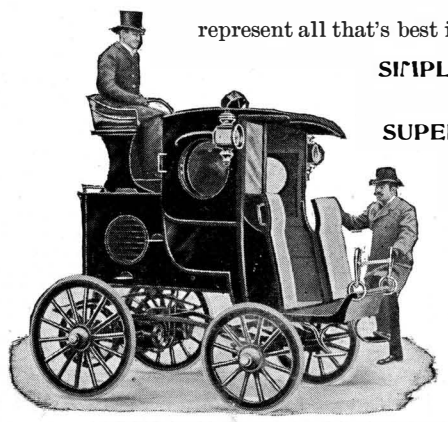

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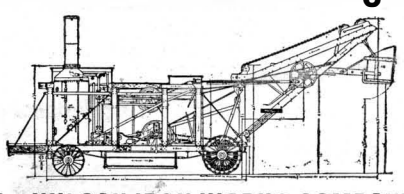

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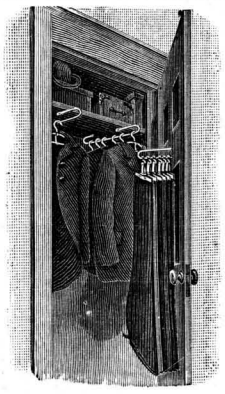

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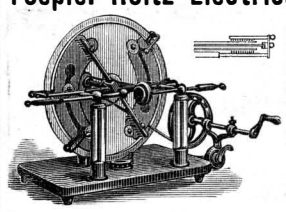

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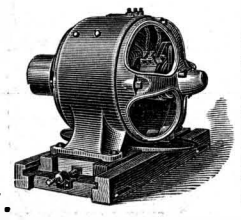

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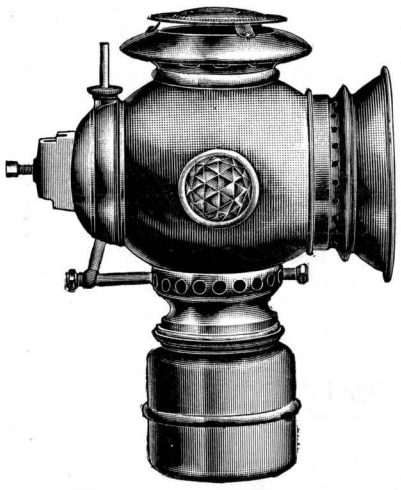

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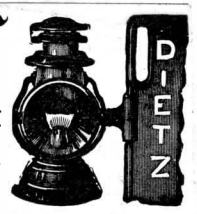

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